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THOUGHT-READING AND MUSCLE-READING.

BY RICHARD A. PROCTOR.

MR. STUART CUMBERLAND has given a *quasi* private exhibition of what he calls his muscle-reading power, at the office of the *Pall Mall Gazette*. It is no injustice to say that the exhibition, however and by whomsoever arranged, was calculated to serve admirably as an advertisement of Mr. Cumberland's capabilities. He and Mr. Irving Bishop are rivals in the art of detecting or recognising—*somehow*—the thoughts of others. Mr. Bishop has achieved a few remarkable feats of that sort, and claims to be able, under suitable conditions, to read thoughts independently of muscular contact. Mr. Cumberland has been as successful under similar conditions, and denies that anyone can read thought otherwise than by noting muscular movements: he claims only exceptional skill in interpreting such movements.

Given Mr. Irving Bishop presenting the matter in one way, we might have expected to find a rival presenting the matter in another way. The claims of Mr. Bishop and the disclaimers of Mr. Cumberland (they must excuse me for not giving always their double-barrelled names) may be alike genuine. But they may also be unfounded. They may be alike clever attempts to duly impress a more or less gullible public. So far as the scientific question at issue is concerned neither one nor the other counts for anything. If I were an exhibitor of thought-reading, finding I possessed a thought-reading power which I could not myself understand and which at times seemed independent of actual contact, I fancy that were my object chiefly to attract attention and get money, I might be tempted to dwell somewhat on my supposed power of thought-reading as distinct from mere muscle-reading. But if I found some one else already in the field—with a double-barrelled name, suppose—I might think it "good business" to say that while *my* powers were at least as great as my rival's, so that I could tell all about the matter, I made no pretension to thought-reading apart from contact. This candid way of meeting the public would be very apt to tell in my favour, and against a "hated rival." (I should double-barrel my name, of course; *cela va sans dire*). By calling thought-reading without contact supernatural, and therefore impossible, I should get a pull upon my adversary, even though he asserted loudly that he claimed no supernatural power at all.

I think neither Mr. Bishop nor Mr. Cumberland has the slightest idea how they do what they undoubtedly can do. Each possesses a remarkable power of interpreting the thoughts of others. Each knows the power to be fitful and variable. Neither can make sure of success in any given attempt; yet each has met with some successes which cannot reasonably be interpreted as due to mere chance. Each has formed a tolerable idea of the unscientific credulity and of the equally unscientific incredulity of the public. One has thought it well to play on the former quality, the other deems it better to play on the latter. But as to a real idea of the nature of the power each feels he possesses, neither one nor the other has any whatever.

Of the experiments performed at the office of the *Pall Mall Gazette*, it may fairly be said that only two even approached the scientific character. The negative result in the case of Mr. Ray Lankester, and the apparently positive success in the case of Mr. Grant Allen, would be interesting and important, if *first* we knew that the former really gave that direction to his thoughts which Mr. Cumberland required, and if, *secondly*, we were fully assured that no outsider knew beforehand about the concealed object of which Mr. Allen was to think.

On the former point, with all confidence in Mr. Lankester's wish to be fair, I doubt whether his strong conviction that Mr. Cumberland could not in any way detect his ideas would not have had a greater influence in colouring his actual thoughts than any other subject which he supposed he was thinking about and really tried to keep constantly present before him. Mr. Cumberland's ready recognition that Mr. Lankester was a hopeless case might, for anything which appears, have been as good a bit of thought-reading as anything done that day at the *Pall Mall* office.

As to the other case, it presents some curious and noteworthy points. There is the possibility that the gentleman who concealed the loaf and suggested the experiment (the writer of the article, I believe) may not have been so careful as he might have been in concealing all traces of what he had done. Mr. Cumberland may have had some hint (from an outsider, of course) that such and such an object had been carefully concealed in such and such a place; and if he knew this, Mr. Cumberland might have had little difficulty in guessing that Mr. Grant Allen had that object in his thoughts and no other. I must confess that, granting the *bona fides* of the gentleman who concealed the loaf, whom I do not know, but of whom I am assured, by those who do know him, that he is confidently to be trusted in this matter, I think it unlikely that the concealment of the loaf would have been noticed by any outsider. But of course this is possible,—at least so far as the published evidence goes.

It is noteworthy, however, that, casually, the experiment was made much more effective than it would have been had Mr. Cumberland gone at once to the concealed object. Mr. Grant Allen, who is by no means a believer in thought-reading, nay whose disbelief verges in my opinion in the—let us say the extra-scientific, thought of the wrong house. Now Mr. Cumberland went to the house Mr. Allen was thus erroneously thinking about, not to the house where the loaf had been concealed. This certainly goes far to prove that by muscle-reading or otherwise Mr. Cumberland

was able to follow the direction of Mr. Allen's thoughts. It does more: it suggests *very* strongly that Mr. Cumberland had no information about the concealment of the loaf in a particular house: for if he had he would assuredly not have been led, by any muscle-indications, to the wrong house.

But there is yet another noteworthy point. Mr. Allen, when he arrived at the door of the wrong house, was wondering in his mind how Mr. Cumberland would get in, whether he would knock or ring. Mr. Cumberland, as if reading the doubt, resolved it by doing both. This may seem a small point; or it may have been a mere coincidence. But it appears to me significant. I do not think any muscular indications can conceivably have suggested the doubt. If they did, muscle-reading is at least as wonderful to my mind as thought-reading pure and simple. In any case Mr. Cumberland's resolute attempt to get into the wrong house confirms strongly the belief that he had no idea about the real position of the concealed object.

As to the question whether thought-reading without contact would be supernatural, I may remark that it would only be mysterious, not supernatural, nor would it be anything like so mysterious as the action of matter on matter without contact, &c., *instantaneously* over distances of hundreds of millions of miles. No man who admits—as every man of science must—that law of attraction which is the most stupendous mystery known to science yet rejects the idea that this great law of nature is not a natural law, need regard the idea of thought transference as involving aught of the supernatural. The influence of matter on matter without contact is at least as great a mystery as would be the influence of mind on mind at a distance.

I should have been glad if a few more men of science had been present, even though the main object of the experiments may have been questionable. The absence of Mr. Labouchere on the other hand was not to be regretted. One wonders, indeed, why he should have been invited. He has never shown any aptitude for scientific inquiry, but on the contrary a very marked development of unscientific incredulity—a quality as fatal to success in seeking after truth as unscientific credulity,—which also, by the way, as usual with unscientific disbelievers, Mr. Labouchere has often displayed. In such matters his one argument has been blatant abuse, his one test *a wager!* A man who has proposed to settle a matter of this sort by laying a wager has *ipso facto* pronounced himself unfit for scientific discussions.

DREAMS:

THEIR PLACE IN THE GROWTH OF PRIMITIVE BELIEFS.

By Edward Clodd.

INTRODUCTORY.

IN a series of papers contributed by the present writer to the earlier numbers of this journal, and since reprinted in the volume entitled "Leisure Readings," the evidence as to pre-historic man's material furniture and surroundings was summarised. Although this evidence was in the main gathered from places with which we are most familiar, it is supported by that which has been collected from every part of the globe inhabited in past or present times, and its uniform character has therefore enabled us to determine what lies beyond an horizon which within the last half century was bounded by the hazy line of myth and tradition. So rigid seemed the limit defining man's knowledge of his past that some forty years ago even the Geological Society passed over with barest reference the unearthing of relics witnessing to his presence in Britain hundreds of thousands of years ago. The canon was closed, and no one ventured to add to the sayings of the book. But the discoveries which had disproved belief in the earth's supremacy in the universe, and in its creation in six days, led the way to researches into the history of the life upon its surface, and especially of that which, in the language of ancient writ, was "made in the image of God." When the long-forbidding line, imaginary as the Equator and lacking its convenience, was crossed, there was found the evidence of the conditions under which man emerged from a state quite other than that which had formed the burden of legends sacred with the hoariness of time. Those conditions, it is wellnigh needless to remind the readers of Knowledge, accord with that theory which holds man to be no specially-created being, started on this earth fully equipped, Minerva-like, with all ripeness of wisdom and loftiness of soul, but the last and long result of an ever-ascending series of organisms ranging from the lowest, shapeless, nerveless specks to *homo sapiens*, "the foremost in the files of time." Evolution is advance from the simple to the complex. The most primitive forms reach maturity in a shorter time than the higher forms, and fulfil their purpose quicker, and this doctrine applies not only in relation to man and the inferior creatures, but as between the several races of man himself. Herein the differences, which are determined by size, still more by increase in complexity, of brain-stuff, are greater than between the lowest man and the highest animals. That is to say, the savage and civilised man are farther apart than the savage and the anthropoid ape. The cranial capacity of the modern Englishman surpasses that of the aboriginal non-Aryan Hindu by a difference of sixty-eight cubic inches, while between this Hindu skull and the skull of the gorilla the difference in capacity is but eleven inches, and if we were to take into account the differences in structural complexity, as indicated by the creasing and furrowing of the brain-surface, the contrast would be still more striking. The brains of the earliest known races, the men of the ancient Stone Age, ape-like savages who fought with woolly-haired elephants, cave-lions, and cave-bears, amidst the forests and on the slopes of the valleys and hills where London now stands, and who in the dawn of human intelligence, applying means to ends, came off victorious, were doubtless much nearer to the chimpanzee with his thirty-five cubic inches than to the Papuan with his fifty-five cubic inches. Indeed, we need not travel beyond this age or island; it suffices to compare the brain-quality of the rustic thinking of "maistly nowt" (one is inclined to class the "masher" with him) with that of the highest minds amongst us, as evidence of the enormous diversity between wild and cultivated stocks in mankind.

Unless we are so enchained to fond delusions as to place man in a kingdom by himself, and deny in the sympathetic, moral, and intellectual faculties in brutes the germs of those capacities which, existing in a pre-human ancestry, have flowered in the noblest and wisest of our race, we may find in such differences as are shown to occur between civilised and primitive man, further evidence of the enormous time since the latter appeared. For unnumbered ages man—then physically hardly distinguishable from apes—may have remained stationary. Certainly the relics from the Drift show no advance. Given no change in the conditions, the species do not vary, and man, once adapted to his surroundings, changed only as these changed. But, obscure as are the causes, there came a period when conditions arose which induced some variation—no matter how slight—in brain development, which was of more need than any

variation in the rest of the body, and when an impetus was given which, leaving the latter but slightly affected, quickened the former, so that man passed from the highest animality to the lowest humanity. Slowly, in the course of a struggle not yet ended, "the ape and tiger" were subdued within him, and those social conditions induced to which are due that progress which ever draws him nearer to the angels.

The discussion of this in detail lies outside the limits of these papers. Here, after briefly noting on what lines it must run, we are concerned with man at that far later stage in his development when the physical and material evidence respecting his bodily development gives place to the psychical and immaterial evidence respecting his mental development. Chipped flints, flakes, and scrapers of the Drift are indispensable witnesses to his primitive state, but during the long ages that he was making shift with them, he remains within the boundaries of the zoological; he is more geological than human. Gleams of the soul within that will one day be responsive to grace of form and harmony of colour appear in the rude portraits of mammoth, reindeer, urus, whale, and man himself, scratched on ivory and horn; indications of germinal ideas about an after-life are present in the contents of tumuli with the skeletons in defined positions and weapons presumably for the use of the departed in the happy hunting-grounds. In these last we are nearing the historic period, for a vast interval exists between the tomb-building races and the men of the Reindeer Period, yet even then the ages are many before man had so advanced as to bequeath the intangible relics of his thought, disclosing what answer he had beat out for himself to the riddle of the earth and the mysteries of life and death. Although the story of his intellectual and spiritual development is a broken one, of the earlier chapters of which we can have no record, enough survives to induce and strengthen the conviction that in this, as in aught else, there is no real disconnection. In the shaping of the rudest pointed flint-tool and weapon there are the germs of the highest mechanical art; in the discordant war-whoop of the savage the latent strains of the "Marseillaise," as, quoting Tennyson, in the eggs of the nightingale sleeps the music of the moon. And if we cannot get so near to the elemental forms of thought as we could wish, we must lay hold of the lowest extant, and trace in these the connection to be sought between the barbaric and the civilised mind. We must have understanding of the mental condition of races, still on low levels of culture, and if the result is to show that many highly-elaborated beliefs among advanced peoples are but barbaric philosophies "writ large," the conception of an underlying unity between all nations of men that do dwell, or have dwelt, on the face of the earth will receive additional proof.

It is therefore with some illustrations of this that our next paper will be concerned.

THE SATELLITES OF MARS.*

BY PROF. PAYNE, EDITOR OF THE *Sidereal Messenger*.

ASIDE from the books written by Professors Newcomb and Holden, and the paper by Professor Hall, very little has been published concerning the satellites of Mars. Though several years have passed since the discovery of these small bodies, scarcely anything new can now be added that will interest the student of astronomy, or the general reader who has access to these valuable books and paper above mentioned. Although this be true, it seems desirable, from the queries of recent correspondents, to make a restatement of what is known of the satellites of Mars for the convenience of readers who may not have the information at hand.

This notable discovery was made August 11-17, 1877, by Professor Asaph Hall, of the Naval Observatory, Washington, D.C. It was not accidental, for Professor Hall began the study of the subject in the spring of that year, examining all authorities within reach, and when the time of opposition came, a systematic search with the great equatorial was undertaken, and prosecuted through discouraging circumstances until the two moons were found, and until it was settled that there were two and not three, as at one time supposed, on account of the rapid motion of the inner one.

It is impossible to convey in words [!] the impression that this discovery made on the minds of leading astronomers everywhere. It was justly esteemed a triumph of patience and skill of high order, to which will be given appropriate place in the history of modern astronomy.

Of the many names suggested for the satellites of Mars, Professor Hall chose those suggested by Mr. Madan, of Eton, England, viz.:—

For the outer satellite, Deimos.
For the inner satellite, Phobos.

The classical scholar will remember that these are the names which Homer applies to the horses which drew the chariot of Mars, and that the passage, as translated by Bryant, reads:—

> "He spoke and summoned Fear and Flight to yoke
> His steeds, and put his glorious armour on."

The time chosen for the search was very favourable, on account of the relative positions of Mars and the Earth. This happens (*sic*) when Mars is as near the Sun as possible, and the Earth as far away as possible, and Mars opposite from the Sun, and can occur only once in fifteen years.

In 1877 these conditions were nearly fulfilled, and the planet Mars was, at nearest approach, about 36 millions of miles from the earth. The sun was in apogee July 3, and Mars was in perigee August 21, and opposition occurred September 5. If these phases of the planets had taken place nearer the same date, the distance between them would have been less, and by so much, observation more favourable.

These satellites are the smallest celestial bodies known. In the largest telescopes they appear as points of light, and hence cannot be measured at all in the ordinary way. The inner satellite is a little brighter than the other, and, therefore, possibly a little larger. Their diameters are probably less than ten miles, and are assumed to be about six and seven miles respectively.

The outer satellite, Deimos, revolves around the planet in 30h. 16m., and the inner one, Phobos, in 7h. 38m. The latter is 5,800 miles from the centre of Mars, and less than 4,000 miles from its surface. It would, therefore, be quite possible with one of our telescopes on Mars to know if the inner satellite is inhabited, for the motion of living beings could be easily recognised.

With these facts before the mind, it is impossible to realise the problem of difficult seeing that was mastered by the aid of the telescope, in observing these minute bodies at the distance of 36 millions. The outer satellite was seen at a distance of about six or seven million times its own diameter; as Professor Holden has aptly said, it is like suspending a ball two inches in diameter and viewing it with a telescope at a distance equal to that between Boston and New York. "Such a feat of telescopic seeing

From the *Sidereal Messenger*.

is well fitted to give an idea of the power of modern optical instruments."

The rotation-time of the planet Mars is 24h. 37m. As before said, the time of revolution of Phobos is 7h. 38m., so that the satellite evidently would revolve more than three times about the primary while it was making but a single rotation on its axis. To an observer on Mars this curious relation of the two motions would cause most interesting physical phenomena, some of which may be briefly noted here. It will be remembered that the motion of the planets around the sun, and all the satellites, with two exceptions, around their primaries, are in the same direction, and that is from west to east. This is also true of the rotation of the planets on their axes so far as known. Now, if this be so, the apparent diurnal motion of a satellite in the heavens will be approximately the difference of the two motions. If the planet rotates on its axis more rapidly than the satellite revolves about the common centre of gravity, then the satellite will appear to rise in the east and set in the west. This is constantly observed in the case of the Moon; also in Deimos, whose revolution period is 30h. 16m. [But] this satellite's motion is a little slower than that of the planet, and so there would be a slow westward apparent diurnal motion that would be very strange to people like ourselves. On the other hand, because of the rapid motion of Phobos, it would appear to rise in the west and set in the east, and because the relative motions of planet and satellite are greatly different, the apparent diurnal motion of this satellite would be as surprisingly rapid to an observer on Mars as that of Deimos was slow. The phenomenon of two satellites rising at the same time—for example, one in the east and the other in the west—and the latter sweeping through the sky eastward, at the rate of about 45° per hour, and, in less than four hours, meeting the other a few degrees above the eastern horizon on its slow westward march, would be a view at first sight almost as impressive as Mitchel's first sunset in Adam's time. Add to this the supposition that the planet Mars is inhabited by beings not greatly unlike ourselves, with telescopes or some other means of aiding the natural powers of sight equal or superior to those we enjoy, and the field of speculation is limitless and interesting to those possessing a lively imagination.

THE EVOLUTION OF FLOWERS.

By Grant Allen.

LILIES AND RUSHES.

On the dry, sunny hillsides behind Mentone, there grows in early spring a pretty little blue lily, erect and usually solitary on the end of a long, stiff stem, and singularly rush-like in its mode of growth and general appearance. It rejoices in the scientific name of *Aphyllanthes Montpeliensis*. As a rule, I don't care to go outside our own wild British flora, or the common cultivated flowers of our gardens, for my main examples, because it is best as far as possible to deal with well-known cases, where the reader's personal interest and memory count for something; and small as our native collection of plants really is, it generally affords quite as good illustrative examples of the various levels of evolution as could be got by ransacking the hothouses at Kew for the rarest and most unfamiliar exotic palms or orchids. This little blue lily of the Riviera, however, with a few of its congeners in Australia or the Malay Archipelago, forms such a beautiful specimen of a bridge or connecting-link between two somewhat distinct families that I am tempted to step aside from my usual practice for once, and interpolate a foreign plant among our illustrations of the evolution of flowers.

Aphyllanthes, as its Greek name imports, has no true leaves; its foliage has all been transmuted into short dry sheathing scales, which clasp and protect the base of each flowering stem. The work usually performed by the leaves—that of taking carbonic acid from the air to be built up into the living material of the plant as starch or cell-wall—is undertaken in this curious lily by the tall, green, rush-like flower-stalks alone. At the top of each such stalk, a few dry, brownish bracts form an involucre or protective covering for the unopened buds; and within this involucre, in due time, a single sky-blue flower (more rarely accompanied by one or two more) opens its bright blossom to the Italian sun. As in the true lilies, there are three sepals and three petals, all alike beautifully coloured; but one of the bracts (or very reduced leaves) here serves the place of a calyx, as the true calyx has been perverted from its original function to share in that of the corolla. There are six stamens, as usual, in two whorls—the three outer somewhat shorter than the three inner; and the pistil consists of three cells, welded firmly together into a single ovary. In short, so far as technical characters are concerned, the Aphyllanthes is a true lily. A botanist who went strictly by the artificial marks set down in the text-books would have no difficulty at all in deciding that it belonged to the true lilies, and not to the rushes. For the distinguishing mark of a rush, in formal botany, consists in the fact that its perianth is "dry and scarious, not petaloid;" and as the perianth of Aphyllanthes is

Fig. 1.—Aphyllanthes Montpeliensis.

bright and juicy, of course it is a lily by definition. But if you look at the accompanying figure of our common English rush, you will see that it differs essentially from Aphyllanthes in hardly anything except the comparative size and colour of the perianth. To be sure, the flowers on each stem are much more numerous in the rush; but that, as we know, is a very small matter; in all other respects the resemblance between the two is extremely noticeable. To put it briefly, Aphyllanthes is a lily far gone on the road toward the rushes—an arrested stage, no doubt, in the development of the family; while the rushes are lilies like

Aphyllanthes which have given up producing brightly-coloured perianths, and taken to small, dry, brown, inconspicuous little blossoms instead.

Why is this? Well, the rushes afford us an excellent example of flowers in a retrogressive condition, though in their case the degeneration has not gone far, and has produced no evil effects upon the habits of the species. All the plants that we have yet considered have been fertilised by insects; the rushes have gone back to the possibly older, but somewhat wasteful, habit of being fertilised by the wind. The pollen is shaken out from their little, loose, hanging stamens by every puff of the summer breezes, and then floats away till it is caught by the three long, feathery stigmas of some other flower. These two conditions of the stamens and stigmas are very characteristic of all wind-fertilised blossoms: the pollen-sacs always hang out in a

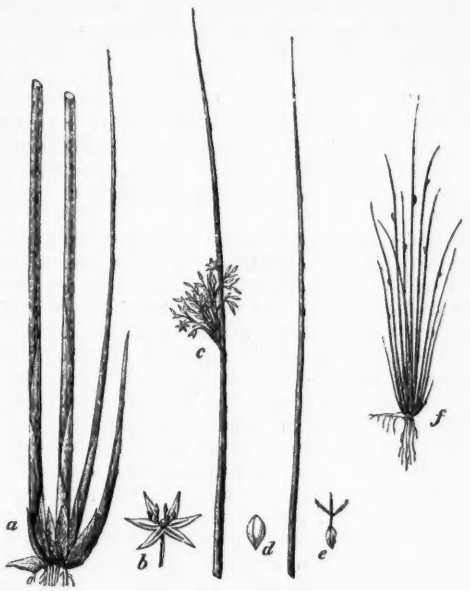


Fig. 2.—Juncus communis.

very mobile fashion, shivering and quivering before the faintest breath, while the stigmas protrude boldly from the centre, and are minutely divided into tiny plume-like points, which catch and retain every grain of the fertilising dust wafted to them by the unconscious breeze.

But how do the rush flowers, then, escape the chance of self-fertilisation with its attendant evils? By a very simple but effectual contrivance. The stamens and stigmas of each blossom do not come to maturity together. The pistil is the first to ripen, and it protrudes its three tiny plume-like stigmas through the bud, before the six dry perianth-pieces begin to unfold; thus, it is pretty sure to catch a grain or two of pollen, carried towards it from some neighbouring head. Meanwhile, the stamens of its own flower are safely huddled up within the tightly-closed perianth. But, by-and-bye, the perianth in turn opens, the stamens unfold themselves upon their long, thin foot-stalks, and the pollen-sacks split down their sides, and shed the pollen lightly to the breeze for the benefit of other surrounding flowers. This is a common device with many wind-fertilised blossoms.

Thus we see that the slight differences between the rushes and Aphyllanthes are solely caused by a single fact in their respective economies; the one is impregnated by the wind, and the other by insects. If the rushes were to take to the habit of insect fertilisation they would doubtless soon acquire brightly-coloured petals like those of the lilies; if Aphyllanthes were to take to the habit of wind-fertilisation it would doubtless soon lose its bright petals, because it would have no further need for them. Nay, they would even become a positive disadvantage to it, inasmuch as they would induce insects (for whose utilisation as carriers it was no longer adapted) to come and plunder it undeterred of its precious pollen. Observe, however, that the rush has not entirely lost its petals, now that they are no longer of use to it as coloured advertisements; it has merely found a new mode of employment for them. By making them hard and dry it has turned them into a protective covering for the stamens before they mature, and as they are persistent (that is to say, do not drop off after flowering) they serve once more as a similar covering for the seeds and capsules during the ripening process. Such economy of existing structures meets us everywhere in Nature as an ordinary accompaniment of evolution.

The flower of the rush is still, however, essentially a lily, with three sepals, three petals, three outer stamens, three inner stamens, and a three-celled ovary, bearing a united style with three separate stigmas. In the common rushes, the seeds are also numerous in each cell, as in the simpler lilies; though in Aphyllanthes and the wood-rushes, they are reduced to one each, for a reason to which I must recur hereafter.

I have left myself hardly any room to notice the most conscipuous external peculiarity of the rushes with which we are usually most familiar. I mean the cylindrical, almost hollow, pithy leaves. But it is easy enough to see the use of these stout, strong, and often prickly-tipped organs; they are, of course, admirably adapted for the places in which rushes commonly grow, in wet, marshy spots, and they serve to protect them against being either trodden down or eaten by cattle. The cylindrical form, however, though frequent among the rushes, is by no means universal; and we can trace every intermediate stage, from the quite flat, grass like, or lily-like foliage of the two-flowered rush (*Juncus biglumis*), through channelled leaves with a fine cylindrical tip like the chestnut rush (*J. castaneus*), to those in which the whole leaf has become cylindrical throughout, like the sharp rush (*J. acutus*) whose very stiff, prickly points are nasty things to pierce one's hand with on the coast in Devonshire.

THE INTERNATIONAL HEALTH EXHIBITION.

By John Ernest Ady.

I.—INTRODUCTORY.

THE odium of comparison sinks into oblivion when we come to apply it to the excellent appointments which have recently been instituted over the site of last year's "Fisheries Exhibition" at South Kensington. Rather let us look upon the arrangements for this year in the light of progressive development; and, when viewed thus, we are insensibly led to congratulate all those who are concerned with the direction of its management.

Of the more obvious improvements we may more specially notice those which provide for the comfort and convenience of visitors. The covered archways, the awned out-of-door spaces, and the judiciously selected spots for refreshment-stalls and their adjuncts. Nor must we omit to mention the superior attractions which appeal more directly to our

sense of the beautiful; the olden houses of London, the lovely illumination, the galleries of costumes, and the musical provision.

It is not within our province to record the minutiæ of the Exhibition as a whole, as a resort for mere amusement, nor will we attempt to give the reader an account of how to make the most of an afternoon at the place, by a hurried and meagre sketch of the multitudinous objects which are to be seen. That has already been done in the daily newspapers, and in sundry brochures both official and non-official. It is necessary, however, that our readers should seek out some such information, in order that they may be enabled to follow us out more fully; and, to that end, we would direct their attention more specially to one of the official guide books, or to the excellent popular reports issued by the *Pall Mall Gazette*, entitled "The Popular Guide to the Health Exhibition," which may be obtained only outside of the buildings, and may as readily be recognised from afar by its hideous orange-brownish paper cover.

In the *Pall Mall Gazette* Guide the author launches forth into an introductory ridiculism, if we may so term it, of the title "Health Exhibition," and the heterogeneity of its contents. Now, if we look somewhat more carefully into the matter, we will be led to discover that the distribution of the, what might be called, "true sanitary exhibits" has been so thoughtfully arranged throughout the allotted space, and so intermingled with its "indirectly sanitary shows," that an end of the greatest importance, viz., the "fitness of all things," is so established. The visitor who comes to idle away a few hours is not surfeited with a continuous round of pleasure; his enjoyment is tempered every now and then by the contemplation of something substantial and useful. The sanitary student, on the other hand, who comes intent on study is pleasurably surprised, and imperceptibly led to find how much easier his task becomes under the soothing influences of a *dîner-à la Duval*, with music thereafter, and when his eye is delighted by exquisite dress, Doulton's potter's art, beautiful furniture, or quaint houses; and then to see the living cows and goats milked! Why, after that, he can go on his sanitary tour with redoubled vigour. But, after all, the veriest pleasures which allure one have their bearing upon health; and some of them, especially those concerned with dwellings and dress, to a very marked degree.

It will be our duty hereafter to make notes for the benefit of our readers of such of the exhibits as bear more emphatically upon health, to point out the advances which they have made over past sanitary measures, and to comment upon them. To submit analyses of such as conduce to personal prosperity and comfort, and to point out how the salubrious condition of small and large communities is and ought to be dealt with. In short, ours shall be a series of "*popular* Health Exhibition reports," equally adapted to the wants of those who desire to attend and view the Exhibition, as to others who are compelled through fortuitous circumstances to remain at home.

From the nature of the subject, and our statements above concerning the arrangements wisely adopted by the Executive Council and Committees, it follows, that much of what we shall treat of will be fragmentary; but our best endeavours shall be exerted to make each fragment perfect. Thus, were we to "follow our nose," we would have to comment upon bronze statues and electroliers, bibles, cabbages, and parasitic pests, vile vegetable dinners, dairies, and such a multifarious crowd of incongruities, that our readers would be justified in using strong "language, not intended for publication, but merely given as a guarantee of good faith." We have, therefore, decided to treat of special exhibits in isolated groups, and to complete, as far as possible, one item in each article.

Let us now conduct our reader to the main entrance of the Exhibition, and thence along the main South Gallery to its termination. We shall have occasion, in future papers, to revisit this "foods and feeding" section of the buildings to notice many things of extreme interest; but, for the present, we shall turn to the right and ascend the staircase leading to the Aquarium—a remnant of last year's Fisheries Exhibition. As noted in our pages at that time, Mr. Maignen's "Filtre Rapide" attracts our attention here, and we are once more constrained to notice this admirable contrivance. We refer to our former pages for an explanation of the essential construction of these water purifiers; and what we then stated concerning their efficiency we are now able to reindorse, after a year's constant usage. In spite of the utmost care of the water companies, whose grand pavilion we shall visit ere long, contamination products do often creep into our household pipes and cisterns: that is unavoidable. But surely it must be the fault of the householder when such useful and inexpensive filters are to be had. M. Maignen has greatly extended his exhibit, and, *pro bono publico*, Filtre Rapide water may be quaffed *ad libitum* in the grounds of the Exhibition, where some of his fountains are set up. The water of the aquaria, too, which has been under his care, seems to be thoroughly purified.

In passing through the Aquarium last week, we observed that nearly all the cod-fish in one of the tanks were infested with numerous brownish parasites or fish-lice (probably *Entomostraca* of the genus *Argulus*). We tried to obtain a few of these for careful examination; but, alas! at the end of the week they had all simultaneously vanished, leaving the fish quite healthy. In another tank a poor solitary Lump-fish (*Cyclopterus lumpus*) attracted crowds of observers to view his uncouth form; he was literally swarming with pests of a peculiar kind, possibly the result of his confined, non-tempestuous prison. Last week he died, but we were not able to procure a single parasite; they had all fled from the presence of death, and were not anywhere to be found. Tank No. 10 deservedly attracts the attention both of naturalists and lovers of aquarian beauty. It is full of exquisite sea-flowers or anemones (*Actiniæ*), many of which were described last year in our columns by Mr. Kimber. Their healthy condition, we find, is largely due to the care bestowed upon them by their energetic keeper, Mr. Edel. Amongst other old friends we may notice the funny little sea-horses (*Hippocampus*) in small aquaria of their own, the curious, spider-like King crabs of the Moluccas, which is, indeed, by some eminent biologists, said to be a kind of spider (*Arachnid*), and the lovely, quiet, golden tench from the Duke of Bedford.

Behind the Aquarium, the new Fish Culture Department is localised; and here may be seen a large tank of pellucid water, with some fine trout and other *Salmonidæ*. The Canadian salmon, which were hatched out last year in the "Fisheries Exhibition," may also be seen thriving here.

From this section we shall pass, next week, into the parallel adjoining Western Gallery, to make the first of our special health inquiries into the processes employed in the aëration of soda-water, beer, fruit, and other drinks. Our remarks will be fully illustrated with engravings.

Car Wheels in the United States.—The number of car wheels in use in the United States is estimated at 10,000,000. About 1,250,000 tyres are worn out each year, requiring about 312,500 tons of iron, about eleven-twelfths of which are supplied by the used-up wheels themselves, which are broken up and recast.

SENT TO THE BOTTOM.

BY RICHARD A. PROCTOR.

(*Continued from page* 365.)

MORE might, of course, be done to make this system of lighting effective. I pass on somewhat doubtfully to note what might thus be tried, because there is a natural and proper unwillingness on the part of most sea captains to have any observations at all nice or difficult to make in time of sea risk. A friend of mine has found very little favour accorded to him (and really he had little right to expect any) when he proposed at a recent meeting of the British Association that when a ship is approaching shore and the weather is thick, the captain or chief officer should make microscopical examination of the water to see what evidence the matter floating in it might afford respecting the neighbourhood of land. Nor again was any very enthusiastic reception accorded by experienced seamen to his idea that in thick weather chemical analysis of the water (taken from before the bows) should be made for evidence of the neighbourhood of any other ship which she might be approaching. I have been at sea under both conditions, and certainly as a passenger I should have been sorry to see these measures adopted instead of the old-fashioned and less scientific ones. In January 1881 the *City of Sydney*, under the command of Captain Dearborn, was approaching San Francisco in thick weather after four or five days during which no observations had been possible. Captain Dearborn did not have water taken on board for microscopical or chemical analysis. I fancy if any one on board of scientific proclivities had come along with a bucket of the sea water and a microscope or means for chemically testing it, and had invited the captain and his officers *very* persistently to investigate the chemical qualities of the water or to seek for evidence about matter held in solution in it, he would have stood a good chance of a rather severe rating even from so courteous a commander as Captain Dearborn. That gentleman had a pestilent habit (to use a phrase Dickens has employed, though it is not quite the right one, even humorously applied) a pestilent habit of attaching very great importance to the seamanly duties on which the safety of the ship and lives entrusted to his care depended; and I have a shrewd suspicion that even the wish to be polite and pleasant would not have caused him to waste a single minute from those duties on the scientific twaddle, which measures too refined for times of danger at sea assuredly involve.

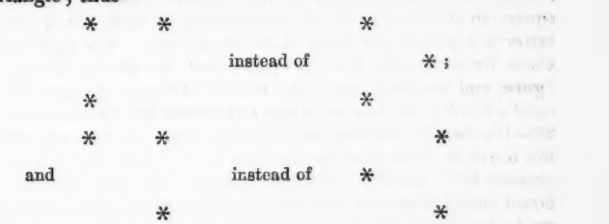
But there are some things which might be learned from the signal lights I have described at a single view, if more were desired than that general information which, as I have shown, those lights would at once afford.

Suppose for instance that the three lights forming the midships triangle were set at a fixed distance from each other in all ships. That distance need not be great, for when a ship is far away it would not be very important that the side lights forming a triangle should be separately seen by unaided vision. If the ordinary night-glass separated them that would do very well. Suppose they were a yard apart. Then the two which are in a vertical line would always lie at their true apparent distance,—apart from rolling and pitching, which since they only carry the hull from one side to the other of her mean position, have no real bearing on the result. In other words there would be no foreshortening in their case as in the case of the other sides of the equilateral triangle. So that even to the naked eye, or as seen in a telescope constantly in use (so that its magnifying power was known) they would give a good idea of the distance of the stranger just as the apparent height of a soldier gives the practised observer an idea of his distance, as seen in a familiar military exercise for judging distances. But it would be easy to arrange matters so that using the ordinary night-glass an officer could at once determine the distance of a strange ship from the apparent distance between her vertical pair of side lights. Three or four fine parallel equi-distant threads, fixed in a small diaphragm at the focus of the telescope's eyepiece, would at once tell this, if they were set at such a distance from each other—say a yard—as seen through the telescope at a distance of 100 yards, would exactly correspond to the distance between two threads in the field of view. This would correspond, if there were five threads, to the span between the two outermost for a distance of 400 yards.

There would be another advantage about such an arrangement as this, in the circumstance that the position of the stranger's hull could be more precisely determined than without such threads. Thus, suppose the apparent distance between the two vertical lights were seen in the night-glass to be four of the spaces between the threads, while turning them horizontally the distance of the forward light of the three from the line joining the others were found to be only about one and three-quarters of the spaces: that would signify that the stranger's hull was inclined about thirty degrees to the line of sight, and so on for other angles.

The field of view of the night-glass might easily be divided into squares by two sets of cross threads, by which arrangement a single observation, or one may say a simple look (by a practised eye) through the telescope, would show the distance of the stranger and the exact position of her hull.

If it seemed better—and there are some considerations which suggest that it might be better—to have two of the three lights at the same level, a right-angled triangle, (with two equal sides) might be substituted for the equilateral triangle; thus—



in this case the two upper lights would be seen simultaneously when as yet the distance of the stranger was so great that the convexity of the water-surface concealed the lowermost from view; and a ship's side-lights would then be seen farther off, the two upper lights showing at a distance as a single light of double the luminosity of either. But so far as the risk of collision is concerned, there would be no special advantage in this arrangement, as there is small risk of collision in any case where a ship's lights can be sighted while she is as yet almost "hull down."

(*To be continued.*)

OPTICAL RECREATIONS.

BY A FELLOW OF THE ROYAL ASTRONOMICAL SOCIETY.

(*Continued from p.* 352.)

WE may take it, for our present purpose, that geometrical optics—with which we shall first deal—has to do with three separate phenomena. (1.) The passage of light through a homogeneous medium (including a vacuum):

which, we have seen, occurs in straight lines. (2.) The effect produced when it passes from such homogeneous medium (or vacuum) into another medium—or back again—and (3.) The behaviour of light incident on what is called a reflecting medium, through which it cannot penetrate and from which it is thrown back. The last shall be first. If we take up any book on optics, we shall find a law enunciated in these (or nearly identical) terms. "When a ray of light is incident upon a reflecting surface, the reflected ray is in the same plane with the incident ray, and the angles of incidence and reflection are equal." The simple piece of apparatus shown in Fig. 5 will serve to

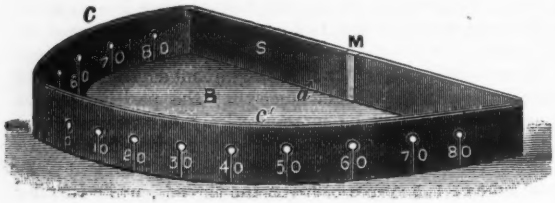


Fig. 5.

illustrate this. Get a piece of board, a foot wide and $\frac{5}{8}$ths inch thick when planed up, and cut out of it a semicircle, B, 12 inches in radius. Against the diametrical edge *d* of this is to be glued or screwed a rectangular piece of board, S, two inches high and $\frac{1}{4}$-in. thick. In a groove in the middle of this, over the centre of the semicircle, is securely fixed a little slip of looking-glass, M, accurately upright, or square to the surface of B. Now we take a strip of stout cardboard, C C′, also two inches in width; fit it carefully round the semicircular edge of B, and cut it off at its ends, where it joins on to the piece S. Having thus gauged its length, we must divide it accurately into eighteen equal parts, drawing lines through such divisions square to the length of the cardboard; so that when the latter is replaced our lines shall be upright. On each of these lines a small hole is perforated, as shown in our figure, and we then mark the middle division 0, those on each side of it 10, the next two outer ones 20, and so on to 90—the two 90's falling on the inner edges of the ends of the board S. Pretty evidently each of our divisions will represent 10°. Finally, we must refasten the strip of cardboard round B by glue and tacks, and so adjust it that when we look through the small aperture in the middle, marked 0, its image shall be seen centrally in our strip of looking glass. Let us place this little contrivance on a table, and light the hole marked 50 by placing a candle close behind it. Then, if the eye be applied to the opposite hole with the same mark, the little lighted circle will be seen shining in the mirror. In any other position of the eye, however, it will be invisible. This experiment should be repeated with the other corresponding holes; or, instead of looking *through* the one opposite to that through which the candle is shining, it may be looked *at* from the inside, and will be seen to be illuminated, while to the right and left of it is darkness. Now the line drawn from 0 square to the surface of the mirror M is the perpendicular at the point of incidence, and a mere glance at our apparatus will show that the angles 60 M 0, 60 M 0, 20 M 0, 20 M 0, and so on, are absolutely equal, and this is what is meant by the law enunciated above. The way in which this law operates in producing the reflection of an image from an ordinary mirror will be easily comprehensible from Fig. 6.

Here we perceive a lady regarding herself in a looking-glass, LL′, the rays of light from her eye, E, falling perpendicularly on to the mirror, will obviously return by the same route, and she will see an image of her own eye precisely in front of it, at E′. The rays from the top of her head, T, will strike the glass at *p*, and if we there erect a perpendicular, we shall find that the reflected ray will follow the direction, *p* E, and, as we always see an object

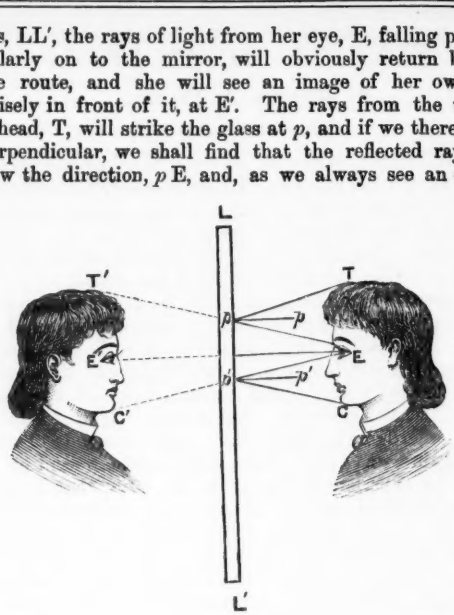


Fig. 6.

in the precise direction in which the rays emanating from it reach the eye, this will seem to come from T′. Exactly the same reasoning applies to the pencil of rays from the observer's chin, C; whence it will be seen that, by the combination of the optical images of every part of her face, her reflected image will be a facsimile of herself (save that obviously it must be reversed right for left), and must appear exactly as far behind the surface of the mirror as she herself is in front of it. A little thought will show that two such mirrors placed parallel to each other, would produce an infinite number of reflections of an object placed between them, but for the loss of light, which ultimately renders them invisible. A pretty and effective toy, shown in Fig. 7, will illustrate this.

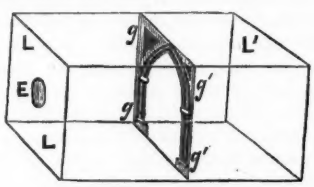


Fig. 7.

Make a box a foot long, six inches wide and six inches deep, and at each end place a piece of good, thin looking-glass, L and L′, six inches square. In the middle of one end of the box a small hole, E, is bored to look through, and the quicksilver must be scraped off that part of the back of the mirror which covers this hole, in order that it may offer no obstruction to vision. Then in the middle of the box must be placed a cut-out scene, painted on cardboard, of some object, whose repetition gives the elements of a picturesque view. Overhanging trees, a single bay of the Crystal Palace, or an arch in a cathedral nave, will suggest suitable subjects. A favourite one with ourselves in our youth used to be an arch of the Thames Tunnel. The cardboard should be similarly painted on both sides, and requires to be very well lighted. Looking through the eye-hole, E, a perfectly interminable vista is seen, and the spectator seems to be gazing along an

endless avenue of trees, or arches, as the case may be. Grooves at g, g' enable the view to be changed at will, and, if it be desired to prevent spectators from getting to the back of the miracle, the top of the box may be covered with finely-ground glass, or with oiled tissue-paper. If, however, instead of placing our mirrors parallel to each other we incline them, we shall obtain a multiplication of images dependent upon the angle of such inclination. For example, if we place two pieces of looking-glass on end on a table touching along one edge, and square to each other, and place a marble between them, and then look down between the glasses, we shall see four marbles—three reflected images and the real marble producing them. If now we close up our mirrors until they contain an angle of 60° only, we shall have five reflected images, so that we shall now see a circle of six marbles, and so on. This is the construction of that extremely well-known toy, the kaleidoscope. The mirrors, in contact at one edge, are placed in a tin or brass tube. One end of this is covered by two discs of glass, the inside one plain, the outer one ground, and between them are broken bits of coloured glass or other transparent material, put in so loosely that they can fall about into all sorts of positions. The other end of the tube is closed, save for a central eye-hole. The resulting effect of most diverse geometrical patterns is too familiar to need any further reference here. Were the mirrors inclined at an angle of 45°, we should have seven reflections (and, of course, eight images), but some of the resulting divisions become very dim from so many reflections. Another amusing piece of apparatus—producing, however, a totally different and startling effect by means of a series of reflections—is often seen at country fairs and similar places, where the showman offers to "let you see through a brick for a penny." Fig. 8 shows the means by which this pseudo-miraculous effect is accomplished.

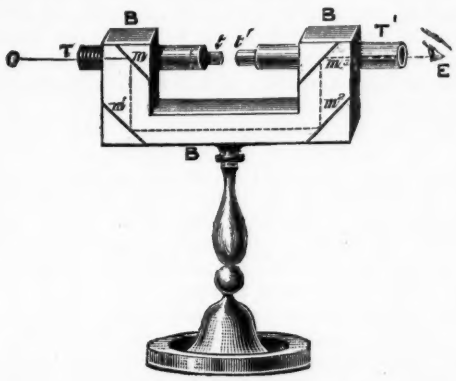


Fig. 8.

It represents the external appearance of the instrument the side next the spectator, however, being supposed to be transparent to show the internal arrangement. We have here a telescope T T' supported by the closed box B, B, B, whose shape will be seen from the figure. The central part of this telescope is separable by the sliding apart for a short distance of the tubes t, t'. When first shown, the ends t, t' are in contact; and in this condition the telescope (which may equally well be a plain tube without lenses) is directed to any object, which will be at once perceived by the eye placed at E. The ends t, t' are now separated, and a brick, or book, or the hand placed between them; notwithstanding which the object towards which the instrument is directed remains as visible as before in every respect The whole secret lies in the fact that at the points m, m^1, m^2, and m^3, are placed four mirrors at angles of 45° (*i.e.*, halfway between vertical and horizontal), with the direction of the rays of light from the object O and the axis of the tube. Hence the light enters the tube, or object-glass of the telescope, at T, and follows the direction T, m, m^1, m^2, m^3, E, shown by dotted lines in our figure, without ever passing through t, t', at all; the spectator being, though, of course, in absolute ignorance that it has not come straight along the line O T, t, t', E.

(To be continued.)

THE MORALITY OF HAPPINESS.

By Thomas Foster.

CARE OF OTHERS AS A DUTY.

(*Continued from page* 346.)

WHILE we thus recognise that our well-being depends so greatly on the well-being of others—their health and bodily capacities, their sense and knowledge, and their moral qualities—that due regard for others is essential to the happiness of self, we see further that each member of the body social gains directly by the possession and exercise of such qualities as lead or enable him to help his fellows. Among the proverbs which present in brief the ideas of a race as to what is good and bad, are many which imply that regard for the interest and welfare of others is bad policy. Such proverbs cannot be regarded as expressing "the wisdom of many" by "the wit of one," for experience proves abundantly that the policy of hardness and indifference is unwise and short-sighted. Even mere material success—which does not always mean happiness—is not advanced in the long-run by disregard of others. The man of business gains in unnumbered ways by consideration for the rights and interests of his fellow-workers, and loses in as many by selfish disregard for them. Nay, even in the trivial affairs of ordinary life, at home and abroad, the kindly and considerate gain constantly, while the careless and indifferent as constantly suffer. It is, however, when we consider happiness as distinguished from mere material success, and the general balance of comfort and enjoyment as distinguished from the effects of individual actions, that we see how much men gain by sympathetic and kindly conduct. We see even first-rate abilities and untiring energy beaten easily in the race of life by the kindliness which makes friends of all around and leads to opportunities which the hard and ungenial fail to obtain. But when we rightly apprehend the nature of life, and what makes life worth living, we find the chief gain of the kindly, not in these material opportunities, but in the pleasanter ways along which their life's work leads them. Compare two men, towards the evening of life, of whom both perhaps have achieved a fair amount of material success in life, but one of hard unkindly manners the other genial and sympathetic, one alone in life's struggle the other with "troops of friends" from first to last. Who can doubt as he compares the worn and weary look of one with the bright and cheerful aspect of the other, that regard for others counts for something towards the welfare and the happiness of self?

Care for others helps so surely in life's struggle that it would be good policy for the naturally hard man to benefit others for purely selfish motives, and still better policy to cultivate kindliness and consideration as qualities sure to be fruitful of profit. The kindly nature which leads to spontaneous goodwill towards others, independently of any consideration of gain to self, is even more profitable than

cultivated kindliness. Those are lucky who possess such a nature—lucky rather than deserving of special credit, seeing that a sympathetic nature is born in a man, not made by culture. Yet the will has much to do with the development of kindliness; and many, by sensible reflection and constant watchfulness over the undue promptings of self, have trained themselves to a kindliness and geniality of manner such as they were not naturally gifted with, and this without any direct reference to self-interest, but as a matter of right and justice to their fellows. Such men deserve much credit for their care in correcting inherent tendencies to undue care of self. The increased happiness of their lives (in so far at least as happiness depends on conduct) is their reward.

Among the good effects of kindly regard for others we may note the reflected happiness derived from those around. Men vary with their company, and undoubtedly the man of sympathetic temperament whose presence is a pleasure to others, finds others much pleasanter in their relations with him than they would be were he of hard ungenial nature. The wife and children of the kindly man are a constant pleasure to him, where the wife and children of the sour-tempered ungenial husband and father are apt to grow gloomy and quarrelsome. His friends and relatives are kindlier than those of the harsh and selfish. Abroad, he sees few faces which do not reflect something of his own brightness and cheerfulness. As Mr. Herbert Spencer well says: "Such a one is practically surrounded by a world of better people than one who is less attractive: if we contrast the state of a man possessing all the material means to happiness, but isolated by his absolute egoism, with the state of an altruistic man relatively poor in means but rich in friends, we may see that various gratifications not to be purchased by money come in abundance to the last and are inaccessible to the first."

But in yet other ways do we find illustrated by the effects of due care for others the saying "to him that hath shall be given, and from him that hath not shall be taken even that which he seemeth to have."

Not only has the hard and ungenial man fewer gratifications but those which he has he enjoys less than the man who cares for the wants and wishes of others. The one loses the power of enjoyment through his over anxiety for self-gratification, the other unconsciously pursues—through his kindliness of character—the very course which a wise and thoughtful consideration of the plan best qualified to secure self-gratification would suggest. The one, while caring unduly for himself, is exhausting and satiating his power to care for any form of pleasure, the other while ministering to the enjoyments of others is fostering his own capacity for enjoyment. Here again if one wished to suggest a course of action by which a man who suffered from life-weariness might again know the charm of happiness, one could advise no better course than to minister systematically to the enjoyments of those around. The very tide of life is made fuller thus, even as the tide of thought is made fuller by turning from mere reflection to an interchange of ideas and thoughts with those around. While there is work to be done in the way of increasing others' happiness, no man—not even the most jaded and satiated—need ask himself the sickly question, "Is life worth living?"

Especially is this so when the tide of life is ebbing. Mr. Spencer's words on this point are worthy of careful study, by those in particular who know of him only as the teacher of some hard unsympathetic system of Gradgrindian philosophy, for they afford an apt example of his kindly and lovable teaching:—

"It is in maturity and old age that we especially see how, as egoistic pleasures grow faint, altruistic actions come in to revive them in new forms. The contrast between the child's delight in the novelties daily revealed, and the indifference which comes as the world around grows familiar, until in adult life there remain comparatively few things that are greatly enjoyed, draws from all the reflection that as years go by pleasures pall. And to those who think, it becomes clear that only through sympathy can pleasures be indirectly gained from things that have ceased to yield pleasures directly. In the gratifications derived by parents from the gratifications of their offspring, this is conspicuously shown. Trite as is the remark that men live afresh in their children, it is needful here to set it down as reminding us of the way in which, as the egoistic satisfactions in life fade, altruism renews them while it transfigures them."

But not only does altruism increase the pleasures of life; the exercise of the altruistic qualities is in itself pleasurable. The state of mind when kindly actions are performed affords pleasure. It directly increases happiness, and thus (like other pleasures) enhances physical well-being. It is true that a sympathetic nature suffers where a hard and callous nature would feel no pain. Undue altruism has no doubt its bad effects, nor can it be denied that even such altruistic feelings as are desirable for the social well being, cause, at times, some degrees of suffering; but the exercise of the altruistic qualities is in the main pleasurable, and it cannot be doubted that altruistic emotions give more pleasure than sorrow. When we sorrow for a friend's grief we experience pain and undergo such depression of the vital functions as always accompanies pain; but in the long run the joy felt in sympathy with the joys of others surpasses the sorrow occasioned by their troubles.

Then too it must be remembered that those pleasures which we derive from the arts owe a large part of their value to altruistic emotions. Consider the pleasure given by a painting representing a scene which moves our sympathies, or the delight with which we read some work of fiction in which kindly emotions are dealt with, and it will be seen how large a portion of our æsthetic gratifications depend on our sympathy with others. The hard and selfish care little for art and nothing for fiction. How should we bear to lose the pleasures which painting and sculpture, music and fiction, afford us? How even should we bear to change the pleasures given by the kindly and sympathetic art of to-day for the harsher effects of the arts of harder times when only deeds of conquest or ceremonial observances were represented in paintings and sculptures, suggested in musical strains, or recited in story or in song? What material gains, what sensual gratifications, what power, wealth, or fame, would make up (to us) for the pleasure we derive from the higher emotions? and how largely do these depend on the sympathies by which men are moved to loving care for the wellbeing of their fellows?

(To be continued.)

THE GULF STREAM.

By William Hosea Ballou.

[I quote this paper from the *Saturday Evening Herald*, Chicago, partly because of its interest, but chiefly because the writer asserts—correctly enough, I daresay—that a theory urged by me, sixteen or seventeen years ago, had been taught earlier in McNally's System of Geography, used twenty years ago in the district schools of America. Mr. Ballou writes as if I had claimed priority and had attached importance to the point. Now, if I know myself at all, I

never cared two straws about priority in such matters. I get interested in a subject, and try to puzzle out the truth respecting it, both by examining the evidence and by inquiring into the reasoning of others. In dealing with such reasoning I always mention by name those whose views I am considering, and where I present reasoning without mentioning any name, it may be taken for granted that I know of no one who has urged such reasoning. But I have never claimed priority or cared for priority in such matters. Nay, I cannot avoid a feeling of contempt for those who do trouble themselves about priority. We want to get at the truth, not to know who first took a particular line towards the truth. If there is anything much more contemptible than claiming priority at all, it is claiming priority unjustly. It is stupid as well as mean. A fellow is sure to be found out. As for presenting another man's theory for one's own, and using his "almost exact wording," that is sheer idiocy. I suppose Mr. Ballou means, in the present case, that my views are so like Mr. McNally's (of whom I now hear for the first time, unless he be the junior member of the well-known American house Rand & McNally) that he—Mr. Ballou—could readily present my views in almost the exact words used by Mr. McNally. This is likely enough. But he ought not to have so worded his account as to leave the impression that I had dishonestly (and most stupidly) tried to deprive Mr. McNally of whatever credit his prior adoption of this particular theory may entitle him to.

It is singular how apt weak-minded people are to imagine "claims" to priority where a man is simply trying to puzzle out the truth. My first book Saturn, chapter V. contained a good deal of reasoning about the Saturnian rings,—immediately comes down on me a Mr. Carpenter, of Greenwich, with the announcement that the real credit of the ideas discussed is due to Professor Pierce (was it, or Clerk-Maxwell? I forget; but I know full credit is given both, in the book). In my book on the Sun, again, all sorts of theories are suggested and discussed, without a word as to claim or credit for ideas naturally presenting themselves in the discussion of the evidence: but,—does not some silly reviewer in the *Athenæum* find in the mere discussion of the evidence "too eager claim for credit?" I wrote to the editor asking for one word of claim to be indicated; but, instead of honest admission of error, he allowed that mendacious reviewer to shuffle off under the inappropriate plea that not the validity of the claims, but their advisability was in question!—the only question being whether they were made at all.—R. P.]

CIRCULATION is not confined to the blood of man nor to the currency of a government or bank. It is the essential factor visible everywhere in nature. The network of the rivers is the life-blood of land, the winds of the atmosphere, and currents of the ocean. It is death to stand long in the snow, because the circulation of the system becomes blocked; thus circulation of some kind is necessary to the preservation of all the elements of nature, social and physical. Man dies when the circulation of the blood ceases. The land would similarly die, so far as habitation or cultivation is concerned, if the rivers should cease their flow. The air would similarly die and no longer afford refreshing breath should the winds cease and the cyclones fail to purify it. The ocean without its currents would soon die, and its surface be blocked with dead fishes and lower forms of animal life. This earth will remain habitable just as long as these infinite methods of circulation are perpetuated; and when the force we call gravitation fails to circulate the orbs in space, the doom of the universe will be sealed.

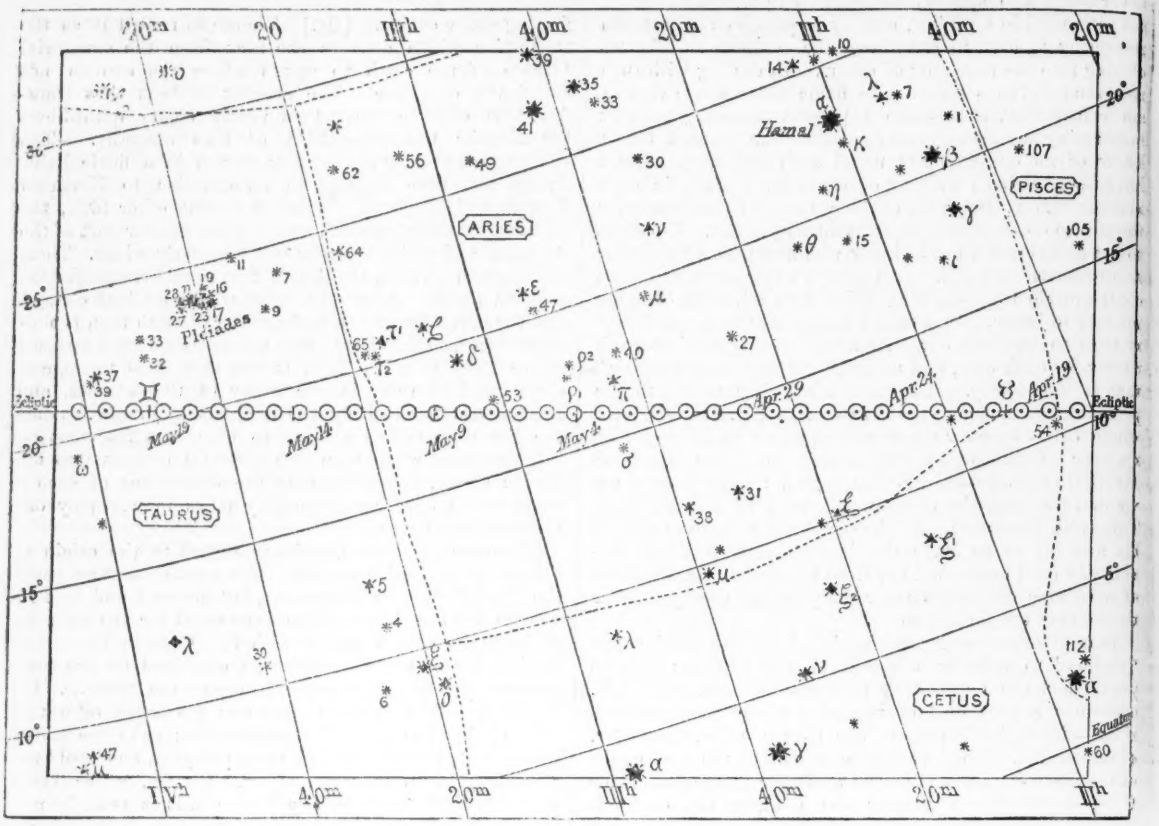
The Gulf Stream is the largest and longest body of flowing water extant. [Qy.] We are to regard it as the steam-pipe which conveys the heat from the equatorial furnace of the earth to points where the sun is not sufficiently operative. The amount of heat thus transferred is easily estimated at nearly eighty quintillions [or *Anglice* trillions.—R.P.] of tons annually. The evidences of geology exhibit this stream in a fickle light. It has not been constant in its devotion to Northern Europe and England. When it sought other idols, the cold currents flowing south occupied the greater part of the Atlantic, and cooled the now moist westerly winds. Then, in Northern France, the Arctic fox, reindeer, and glutton prowled about. After this, there was a gradual change, and the current returned with greater warmth than is now experienced, so that the fig-tree and canary-laurel flourished where Paris now is. Then it was that lions, tigers, and elephants held sway in the valley of the Thames, and London was founded by the denizens of jungles. Some one has been foolish enough to express a fear that an isthmian canal would turn this powerful current into the Pacific Ocean, forgetting that the dimensions of such a canal would *hardly* average fifty miles in width by one thousand feet depth.

There are numerous theories in regard to the origin of this perpetual-motion current. The most ancient supposed the Missi-sippi river the parent, but it was found that its volume was one thousand times too small for the purpose, although its waters mingle with it. Captain Livingston ascribed it to a sort of yearly tide, conceived by the sun's apparent yearly motion and influence on the Atlantic. Dr. Franklin held that the stream was the reflux of waters piled up in the Gulf by the trade winds; but these gentle breezes only blow about 111 days per year, and could not possibly pile up so much water. Besides, water being eight hundred times heavier than air, it is scarcely presumed that the trade winds develop strength enough for such a task.

Captain Maury next took into account the action of the sun's heat. He believed that the water at the equator was made lighter by the action of the sun, and flowed over the surface toward the poles. The cold water of the Polar seas rushed in to take its place, but, being heavier, formed a submarine current.

Sir John Herschel maintained that such effects were impossible, since, if the waters became lighter, they could only have an upward, downward, or sidewise tendency. The latter could only result from the gradual sloping caused by the bulging of equatorial waters. Such a slope was too slight for such an effect.

Richard A. Proctor, the astonomer, next takes the stand, and argues for a theory most generally held to-day. He proceeds to show that the great heat of the sun at the equator has a drying as well as a warming effect on the waters. It evaporates enormous quantities. This causes an intense suction to take place over the whole equatorial Atlantic, and a submarine current of cold waters from the poles results, and takes the place of the waters evaporated, also causing a surface flow of warm waters towards the poles. He says: "Having once detected the main-spring of the Gulf Stream mechanism, or rather the whole system of oceanic circulation—for the movements detected in the Atlantic have their exact counterpart in the Pacific—we have no difficulty in accounting for all the motions which that mechanism exhibits. We need no longer look upon the Gulf Stream as the rebound of the equatorial current from the shores of North America. Knowing there is an underflow towards the equator, we see there must be a surface-flow towards the poles. This must inevitably result in



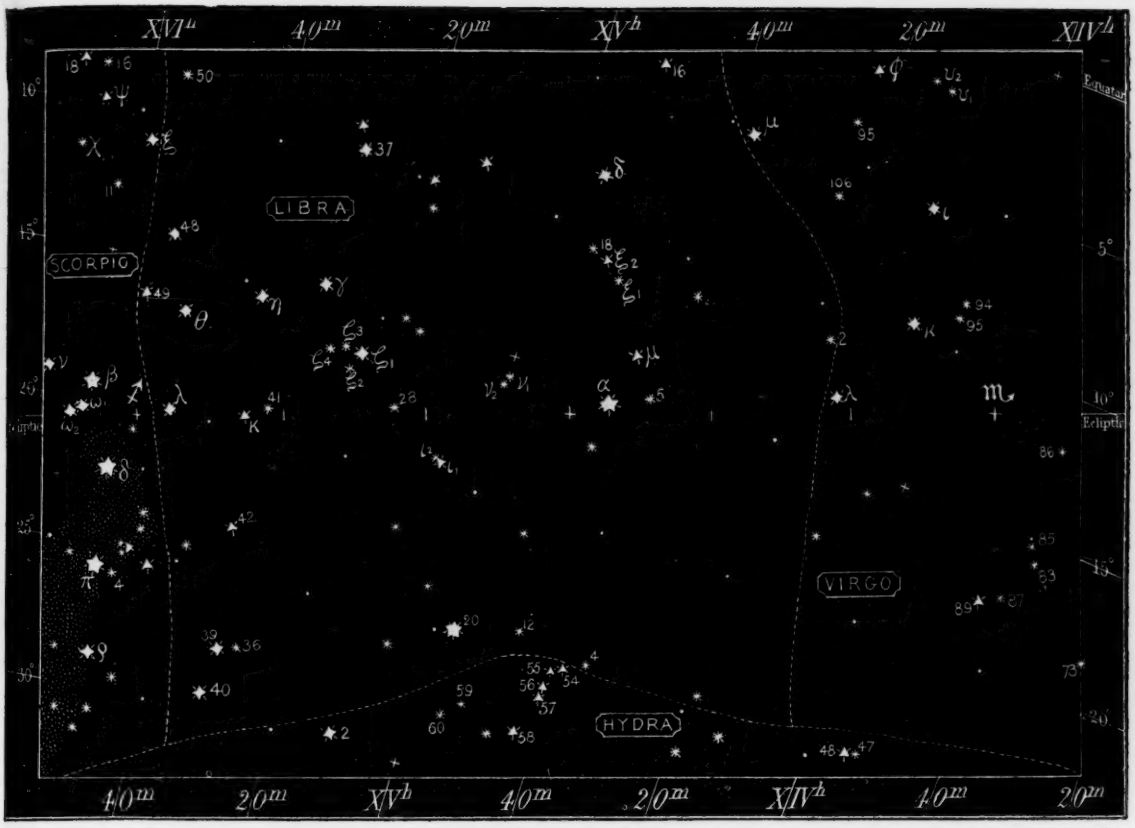
The Day Sign for the Month.

an easterly motion, as the underflow towards the equator results in a westerly motion. We have, indeed, the phenomena of trade and counter-trades exhibited in water currents instead of air currents."

I protest in the name of every student who attended the district school twenty years ago, that this Proctorian theory is almost the exact wording of that of Francis McNally in his "System of Geography," then studied. Yet at that time the Royal Geographical Society was questioning the very existence of the Gulf Stream. In brief, our unpretentious geographer, who made but a three-page analysis of the physical features of the earth, quietly advanced the only correct theory of oceanic currents which were only advanced in after years by the great scientists abroad as a result of a regular process of evolution of ideas, given in the last paragraphs. To my own mind, all the causes taken into consideration, which were either accepted or rejected, contribute their quota to oceanic currents. The vast volume of water constantly contributed by the Mississippi and tributaries must render a portion of the prodigious force and volume of the Gulf Stream possible. The trade winds banking up waters in the Gulf must add something by the reflux. The bulging of equatorial waters may contribute a little. Of course, the evaporation by the sun is more potent than all other forces combined; but Richard A. Proctor has not an iota of claim to priority for that theory.

The equatorial current is not continuous as a submarine flow. The United States Coast and Goedetic Survey has prepared a map, showing an "inner cold wall" from outside New York to Cedar Keys, by which term is meant the equatorial current, flowing from the Arctic Sea. It is not surprising, then, that the warm waters of the Gulf sweep the bed of the ocean for many hundreds and perhaps thousands of square miles. It consequently happens that its bed, as well as the Gulf Stream itself, has a distinct fauna and flora of its own, perhaps the most marvellous in any area of the globe. The dredging and trawl nets of the United States Fish Commission in this area have brought up literally thousands of new species of fishes and the lowest forms of animal life. There seems to be no end to the species discovered here. Every year a new section of ocean bed is explored, and a new series of animal life brought forth. The warm waters of the Gulf Stream, bringing a constant supply of food and soil from the Gulf and the far interior of the west and north-west United States, makes this a rich field for the support of life. Here, too, have been discovered the breeding and hiding places of large schools of new or long-known edible fishes. One acre of land on the ocean-bed touched by the Gulf Stream is worth a hundred acres of the richest prairie land. The products of this area find their way to Chicago, and may be had at the table in a line of eating-houses and dining-cars as far west as Salt Lake City. Thus the soil which is lost to the West by the depradations of the Mississippi is returning its par value with interest to the same West by aiding in the support of food-fishes far out in the Atlantic.

The Metropolitan Railway now issues 72,000,000 tickets yearly, of which 80 per cent. are third class, averaging 1·8d per ticket.



The Night Sign for the Month.

ZODIACAL MAPS.

By Richard A. Proctor.

WE give this week both the day sign and the night sign for the month, one showing the zodiacal sign now high in the heavens at midnight, the other showing the region of the zodiac athwart which the sun pursues his course at this part of the year.

MOVED FROM AFAR.*

II.—THE WILL.

(*Continued from page* 348.)

WE choose an experimental case which is of interest as showing a "subject" midway between the normal and the mesmerised condition. It is interesting, too, as the first publication, on first-hand authority, of an after-dinner incident which made much sensation in Yorkshire society when it occurred, and which even twenty years afterwards was still alluded to with bated breath as a manifest proof of the alliance of mesmerists with the devil. The modern inquirer will rather regret that this diabolical assistance was so frequently perverted to mere works of charity and mercy; for Mr. H. S. Thompson (formerly of Fairfield, now of Moorlands, near York) has devoted his almost unique mesmeric power mainly to the cure and comfort of his tenantry and poorer neighbours, and has only incidentally made, and rarely recorded, those experiments on "the silent power of the will" which few men, we fear, in a generation are able to repeat.

"Moorlands, York, November, 1883.—Dear Sir,—I will give you a sketch of some of the experiments I have tried, and which lead me to the conclusion that the will is sufficient to influence some people either far or near. In 1837, I first became acquainted with mesmerism through Baron Dupotet. The first experiment I tried was upon a Mrs. Thornton, who was staying with some friends of mine, Mr. and Mrs. Charles Harland, of Sutton. She told me that no one had ever succeeded in mesmerising her, though she soon submitted to being mesmerised by me. She went to sleep at once, and was very strongly influenced by my will. One night when I was dining with Mr. Harland, after the ladies had left the room, some gentleman proposed that I should will her to come back again, which I did. She came directly, and after this I could not go to the house without her going to sleep, even if she did not know that I was there. I have met with many cases of thought-reading, but none so distinct as in a little girl named Crowther. She had had brain fever, which had caused a protrusion of the eyes. Of this ill effect I soon relieved her, and found that she was naturally a thought-reader. I practised on her a good deal, and at length there was no need for me to utter what I wished to say, as she always knew my thoughts. I was showing some experiments to a Dr. Simpson, and he asked me to will her to go and pick a piece of white heather out of a large vase full of flowers there was in the room,

* From a paper on Apparitions, in the *Nineteenth Century*, by Messrs. Edm. Gurney and Fred. W. H. Myers.

and bring it to me. She did this as quickly as if I had spoken to her. All these experiments were performed when the girl was awake, and not in a mesmeric sleep.—Believe me, dear Sir, yours truly, Henry Stafford Thompson."

The following cases differ from the last in that the desire became operative at a distance, without any expectation of such a result on the part of the person who exercised it.

Extract from a letter to Professor Sidgwick.—"Cathedral Yard, Winchester: Jan. 31, 1884.—Sir,—As a constant reader of the *Times*, I have noticed the 'Proceedings' of the Psychical Society, and as your society has invited communications, I respectfully beg to offer you a short statement of my experience on a subject which I do not understand. Let me premise that I am not a scholar, as I left school when twelve years of age in 1827, and I therefore hope you will forgive all sins against composition and grammar. I am a working foreman of masons at Winchester Cathedral, and have been for the last nine years a resident of this city. I am a native of Edinburgh. It is now more than thirty years ago that I was living in London, very near where the Great Western Railway now stands, but which was not then built. I was working in the Regent's Park for Messrs. Mowlem, Burt, & Freeman, who at that time had the Government contract for three years for the masons' work of the capital, and who yet carry on a mighty business at Millbank, Westminster. I think it was Gloucester-gate, if I mistake not. At all events it was that gate of Regent's Park to the eastward of the Zoological Gardens, at the north-east corner of the Park. The distance from my home was too great for me to get home to meals, so I carried my food with me, and therefore had no call to leave the work all day. On a certain day, however, I suddenly felt an intense desire to go home, but as I had no business there I tried to suppress it,—but it was not possible to do so. Every minute the desire to go home increased. It was 10 in the morning, and I could not think of anything to call me away from the work at such a time. I got fidgetty and uneasy, and felt as if I must go, even at the risk of being ridiculed by my wife, as I could give no reason why I should leave my work and lose 6d. an hour for nonsense. However, I could not stay, and I set off for home under an impulse which I could not resist. When I reached my own door and knocked, the door was opened by my wife's sister, a married woman, who lived a few streets off. She looked surprised, and said, 'Why, Skirving, how did you know?' 'Know what?' I asked. 'Why, about Mary Ann.' I said, 'I don't know anything about Mary Ann' (my wife). 'Then what brought you home at present?' I said, 'I can hardly tell you. I seemed to want to come home. But what is wrong?' I asked. She told me that my wife had been run over by a cab, and been most seriously injured about an hour ago, and she had called for me ever since, but was now in fits, and had several in succession. I went upstairs, and though very ill she recognised me, and stretched forth her arms and took me round the neck and pulled my head down into her bosom. The fits passed away directly, and my presence seemed to tranquillise her, so that she got into sleep, and did well. Her sister told me that she had uttered the most piteous cries for me to come to her, although there was not the least likelihood of my coming. This short narrative has only one merit; it is strictly true.—Alexander Skirving."

Dr. Fischer, whom we quoted, describes how he was himself once driven forth from the midst of a jubilee-dinner, by the urgent desire (as it turned out) of a person whose need of his attendance was at the time quite unknown to him; and we have reason to believe that the experience is by no means unique in medical practice. We received the following very similar case from Mrs. Clow, 11, Upper Hamilton-terrace, N.W.:—

"Dec. 17, 1883.—On Dec. 2, 1877, I was at church. My children wished to remain at a christening. I said, 'I cannot; somebody seems calling me; something is the matter.' I returned home to find nothing; but the next morning two telegrams summoned me to the death-bed of my husband, from whom I had had a cheerful letter on the Saturday, and who left me in excellent spirits the Tuesday before. All Sunday he was dying, and my friends could not telegraph, and there was no train. I only arrived in time to see him die. As soon as I read your letter, my sons both said they remembered the circumstance quite well, and signed the enclosed. George was ten years old, John twelve years.—Ellen Clow."

"We remember perfectly our mother leaving the church, saying she felt she was wanted—some one was calling her. The next day our father died, December 3, 1877.—George Clow, John A. Clow."

Here we have instances of an impression powerful enough to produce a distinct and unusual course of action—for Mrs. Clow assures us that, under ordinary circumstances, she would certainly have remained where she was—yet so obscurely seated in the mind that its own source remains unrealised and unknown.

(*To be continued.*)

Asbestos Paint at the International Health Exhibition.—A fire broke out at one of the exhibitor's stands in the central annexe of this Exhibition early on Saturday week, but was confined to the room in which it originated by the resistance offered by the asbestos patent fireproof paint with which the timber walls were coated fifteen months ago by the United Asbestos Company, of London. The authorities are to be congratulated on having escaped so lightly, also the United Asbestos Company, on this additional proof of the practical value of their paint.—*Engineering.*

The Refraction of Waves.—At the Birmingham meeting of the Physical Society, on May 10, Professor J. H. Poynting exhibited an experiment designed to illustrate by means of water waves the refraction of waves when they pass from one medium to another in which the velocity is different. The apparatus consisted of a tank 2 ft. 6 in. square with a plate-glass bottom. Water is poured into the tank to a depth of, say, five or six millimètres. The lid of the tank consisted of a calico screen, and was slightly tilted up. A naked lime-light placed under the tank threw on to the screen a picture of the waves in the water. Plates of glass three or four millimètres thick were placed in the tank, thus reducing the depth of the water. If waves were now sent across the tank they travelled more slowly across the shallower water over the plates and were seen to be refracted. When circular or lenticular plates were employed it was easy to show that the refracted waves converged to a focus.

This is the order in which the 1.15 train from Waterloo was made up on Sunday week:—(1) Engine, (2) a very old van, (3) a second-class carriage, (4) a first-class carriage, (5) a third-class carriage, (6) a first-class carriage, (7) a third-class carriage, (8) a first and second composite carriage, (9) a third-class carriage, (10) a composite first and second-class, (11) a first-class, (12) a third-class, (13) a brake-van, (14) a first-class, (15) a composite first and second-class, and finally, three vans for milk, &c. Nicely-arranged train! So easy for passengers to find the sort of carriages they want—first, second or third-class, very old, old, or recent!—*Engineer.*

Dr. Lecher recently made an experiment to prove whether Faraday's famous experiment of rotating the plane of polarisation by an electric current could be inverted. He has attempted to generate currents by rotating the plane of polarisation of light. The arrangement was as follows:—A ray of plane-polarised light was sent through the interior of two powerful helices of wire situated at some distance from one another. Through the first of these a powerful alternate current was sent, which impressed upon the ray a rapid oscillation of its plane of polarisation. The second helix was connected to a sensitive receiving telephone in the hpeo that sounds might therein be heard, as would be the case if the rapid rotations in the plane of polarisation of the ray were capable of setting up currents in the surrounding wire. Absolutely nothing was, however, heard.

Editorial Gossip.

THE foolish lad, Castles, led by Bandit-and-Pirate literature to enter on a buccaneering career, and now in prison for wounding a policeman, is an illustration of reversion to ancestral types. It is a case of atavism. We all pass in our babyhood through the monkey stage, and in our childhood through the savage stage of life, as certainly as before birth we passed through lower stages still. Every boy passes through the warlike stage (of course, the goody-goody boy is only the exception proving the rule—being a monstrosity and utterly abnormal). Day dreams of chivalrous deeds, of the valorous and effective wielding of sword and spear, curtal-axe or mace, of riding on powerful destrier or on more active war-horse, fighting *à outrance* for imprisoned princesses, and so forth, passed through the minds of all of us, I take it, when we were boys. Yon curly-headed lad of yours, who paces along with your walking-stick over his shoulder, or swordwise by his side, his eyes turned inwards (as Charles Reade puts it) is dreaming of such deeds even now. "I would myself have been a soldier," if in after-life I had carried out the ideas of my boyish days,—unless I had been an equally doughty sea-warrior. And though I smile when I see my youngsters so full of warlike thoughts, at that particular stage of life, I should be sorry to see them otherwise. It is inborn in the race, this love of fighting,—a natural part of a boy's life. He is tolerably sure to grow out of it,—unless, of course, he inherits no better traits, the development of which belongs to later years.

BUT sometimes—as in the case of the unfortunate lad Castles, this fighting element in the blood shows itself with altogether exceptional strength. That it should be associated with bandit notions or piratic aspirations, is nothing. Your own boy in the warrior stage is as ready to be a great (but generous) highwayman, or a daring (but on the whole kindly) pirate, as to be a general or an admiral. He has a dim idea indeed, that predatory chieftainship is more easily attained than more formal military or naval distinction. But in his case there is in the background a steadying influence. He knows, though he would not admit as much for a good deal, that after all it is "only pretend." Even Dickens's boy pirates though they pretended very fast, yet stopped short of actual deeds of daring, — and their young brides (of from five to ten last birthday) asked ungrammatically with tears in their pretty little eyes, If grown folks won't pretend too, what use is our going on? But every now and then we have a case in which the boy bandit does go on, and goes on pretty far. He is for the time possessed by the spirit of his remote progenitors. He is as much out of place as a rock pigeon among tumblers, or a striped horse in a stable where all the rest are of the modern breed. We must of course keep him out of mischief; but his case is to be pitied. There is no wickedness about him. He can no more control that inherited trait of ancestors too remote for any use, than he could prevent the undue development of canine teeth or a gorilla-like length of arm.

WE see elsewhere, in ways less remarked, the survival of ancestral tastes now utterly unsuited to the environment. The country squire in headlong pursuit of a fox is an apt illustration. He does not want the fox. He can acquire skill in riding and get a sufficient amount of exercise in many better ways. His hunting dogs have no value outside this useless work. Nothing comes of it all—unless he chances to break a limb or his neck. Yet he goes on at it all his life as if it were some worthy pursuit benefiting not himself alone, but the whole human race!

THE hearty country squire corresponds in a sense with the healthy boy longing for war and plunder glory and blood. He illustrates a stage in the development of a race, even as in the lad the development of the individual man is illustrated. But what shall we say of beings like those who find sport in shooting at wretched pigeons let out of traps? They are rather survivals like the unfortunate little ruffian recently imprisoned. Their fault is rather stupidity than mere cruelty. There was something as pitiable in the defence they made, in the House of Lords, as in the only pleas which can be urged in extenuation of the offence of young Castles,—like him, they were born so. They (obviously) know no better. The process of Development has not yet eliminated their inherited savagery.

I FANCY there are some few cricketers at this moment who rather regret that something has not been done in the direction I indicated a year or two ago. It is apparently a settled conviction in the minds of the cricketing community that a great match must depend on two innings a-side, whether these be long or short, too long perhaps to be completed in the allotted time, or so short that the match lasts but half the time assigned to it, or even less. Why a match should not last out the allotted time, and be determined by the doings of the rival teams in that time, no one can say. One would imagine that men who really loved cricket would be sorry to see a match undecided for want of time, or match after match, as of late, completed so soon as to leave a large part of the time assigned to it wasted. Yet, again, one would suppose all real lovers of the noble game would be unwilling to see a match made unfair by chances outside those inherent in the game itself,—as if *these* were not enough. Yet by the present arrangement we constantly see an eleven defeated through sheer chance, outside the cricket chances. Even in the fine weather we have had lately this has been so. Only a few days ago I saw an eleven sent in to bat, after their opponents had had all the best of the day, with so bad a light that half their batting strength was lost, and five of their best wickets fell ingloriously. In many matches yet to be played this season we shall see the like.

THE united wisdom of Marylebone seems unable either to see how much the game is injured by such defects, or how they might most readily be removed. Just now, however, the pockets of many skilful cricketers are feeling the effects of cricket conservatism. One whole day lost at Lords, another in the match with Surrey, two whole days at Birmingham, all this means a large loss of money besides many opportunities for good cricket wasted.

THEY talk of narrowing the bat, because it looks as if the bat were getting rather the better of the ball. The match at Birmingham suggested quite the reverse. But there is one way of helping the bat against the ball effectively, which was urged as a fatal defect in the plan I suggested. According to that plan, a batsman would not have the same advantage from getting his eye in as by the present system, though when two got well set, *together*, there might be a good deal of leather-hunting. This, which was urged as a defect, was really an advantage. For however pleasant it may be to the batsman, very long scoring is not a good feature in a match. By the suggested plan the test of the opening overs would come oftener and be

severer; but it would affect all alike, and by helping the ball against the bat, would meet a growing want.

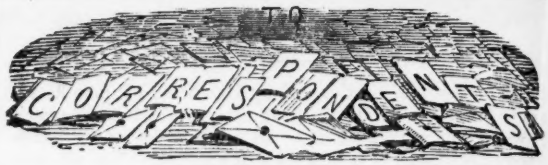
But then it is a settled custom for an eleven to take about half an hour in going out to field,—and this custom of course must not be changed! Better nine matches out of ten were unfinished each season.

I have been struck by the wide room there is—even with the best elevens—for improvement in the science of fielding. Men practise bowling and batting systematically, wicket-keeping and long-stopping with fair steadiness. But practice in fielding is haphazard. (You often see practice in stopping straight-thrown balls, but fielding is not merely stopping the ball.) Thus even in important matches you constantly see ill-judged fielding, the line taken being far from the best for quick return of the ball. You see a man run towards the ball, when his only chance of intercepting it is by running towards a point in its course farther from the wickets, and on the other hand you often see a fielder run to such a point and then have to wait for the ball, where by running to a nearer point he could have met it sooner. Onlookers note as bad fielding cases (of frequent enough occurrence they are) where the fielder runs across the ball's course and has to work back to it; but a run is often lost where no such obvious mistake has been made. Practice in fielding by which instinctively the right course is started on for taking the ball neither too near nor too far, but just where it may most quickly be taken, would be good too for judging catches, and would prevent such misjudgment as was repeatedly noticeable in the contest between the Australians and Marylebone. What can be done in this way we may see in the fielding of Mr. A. P. Lucas, who takes as by instinct (begotten really by practice) the precise course for reaching the ball soonest. His marvellous catch at the Oval in 1882 was worth going miles to see, as an illustration of perfect judging; as Bonnor drove the ball, Lucas seemed to start at full speed, his course was not appreciably changed as he ran at his swiftest all the time, and he just reached the ball on the boundary: had he succeeded only in touching it he would have deserved as much applause for his perfect attempt as he obtained when the catch came off.

In theory, fielding is the most purely scientific part of cricket.

Wonderful Bicycle Ride.—Mr. J. H. Adams, who started from Land's End on Saturday, the 17th inst., at 5.20 a.m., arrived at John O'Groat's on Saturday, the 24th inst., at 5.5 a.m., thus accomplishing the distance—about 930 miles—in 6 days 23 hours 45 minutes, and beating all previous records, including those of Keith-Falconer, Nixon, and Lennox by from 3 to 7 days. Mr. Adams rode a 46-in. "Facile" Safety Bicycle, and was accompanied throughout, partly by road and partly by rail, by Mr. Tom Moore, of the *Bicycling News*. Mr. Goodwin, of Manchester, who started from Land's End on a 38-in. "Facile" 24 hours in advance of Mr. Adams, also rode the entire distance in 8 days 15 hours, thus beating all records but the above.

Overhead Wires.—The decision of the Railway Commissioners which was given last week, concerning overhead wires in Wandsworth, is opposed to that of Mr. Justice Stephen, who in the Telephone Company case held that the local authority had absolute power over everything between the street-pavement and the sky. The Railway Commissioners have decided the local board authority is limited by the powers conferred by the old Post Office Acts. The Post Office carry up to five wires overhead, but more than five wires they put underground. The recent decision, therefore, is that when there are few wires it is quite legitimate to carry them overhead, providing that all the wires are of copper, all the standards of iron, and that when a wire crosses a street the distance between the two supports does not exceed one hundred yards.



"Let Knowledge grow from more to more."—Alfred Tennyson.

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TRICYCLES.—TWO-TRACK MACHINES.

[1269]—A correspondent requests that I will give my views on two-track machines. For fairly level ground, I consider the central-geared Coventry Rotary the best two-track machine made, but it is not a good machine for specially hilly districts, as the wheel is apt to skid in mounting steep hills. The machines of the second type, which have a pair of large double driving-wheels, and the steering-wheel placed on one side, either in front of or behind the larger wheels, obviate this difficulty, but introduce another. The wheel-base of the machine is reduced to a minimum, and it is much more likely to turn over than a machine of similar make with the steering-wheel placed centrally between the two large wheels.

I must take the opportunity of thanking the editor for defending me for a want of courtesy when riding, but I will allude further to the matter in an article which I propose to communicate very shortly.

John Browning.

STRANGE DREAMS.

[1270]—A few nights since I was unable to sleep, owing to an attack of toothache; after a long time I became unconscious for an unknown period, and awoke, laughing at the following ridiculous dream:—

I thought there were about a dozen persons in a large room, all of whom were adults, except one child about a year old, who sat in a conspicuous position, bolt upright. There was not a particle of hair on the child's head. One of the company prayed aloud in these words:—"O Lord, bless the old men and maidens, the young men and children, and *the bald-headed coot.*"

The allusion to the child's absence of hair being so appropriate and a surprise, was too much even for a dreamer—I awoke laughing. Although I had to get up and pace the room in pain, I could not avoid laughing at the concluding words of the prayer.

J. Hammond.

[The dream illustrates oddly the way in which old memories, supposed to be dormant, may be aroused in dreams. Mr. Hammond seems even now not able to recall hearing or reading the story. It is, nevertheless, an old one.—R.P.]

RECALLED IMPRESSIONS.

[1271]—Your article for May 9th on coincidences and superstitions calls to my mind certain experiences of my own, as well as suggests a solution of them. On one or two occasions when I have been experiencing some unusual occurrences, the conviction has forced itself upon me that I have experienced exactly the same combination of circumstances before. I could not possibly have done so in the waking state, as it has occurred at places which I have visited for the first time. I have therefore had no alternative but to conclude that a corresponding experience has occurred during a dream. If there are two distinct series of mental impressions, each alternately shading into each other as in waking and sleeping, is it contrary to the law of probability that a particular combination of impressions in the sleeping state should happen to closely correspond to a combination of impressions in the waking state subsequently experienced? According to Herbert Spencer a discharge having passed through a nervous plexus, makes a subsequen

discharge easier. If, then, a waking experience sent a discharge along the same combination of nervous structures as had been sent during a sleeping experience, would not the greater ease with which the discharge passed generate a conviction that the same event had occurred before? Considering the immense variety of impressions we have in dreams, all of which soon pass out of memory, but which must nevertheless have worked their effects on our nervous structures, may not the experience I have mentioned, and perhaps some other mental phenomena, be explained as the occasional coincidence of waking impressions with previous sleeping impressions?

At the close of your article, after speaking of the theory of brain-waves, you add, as if apologetically, "I express no opinion." This would seem to imply that you are anxious not to identify yourself with any opinion on the subject. I have a conviction that a great many men of science avoid investigating mental phenomena from a fear of appearing to give any countenance to the theories of Mesmerists and Spiritualists. Because these theories are mostly wrong, they are assumed to be entirely wrong. This unwillingness to recognise the "soul of truth in things erroneous" has, I believe, serious consequences, causing, as it does, the investigation of the phenomena to be left to uncultured minds—minds which, like the savage's, are liable to assume supernatural agency on the slightest pretext; whereas, if they were investigated by men capable of doing so impartially, valuable truths might be discovered, and perhaps much light thrown on subjects that are at present obscure.

G. E. SUTCLIFFE.

IRELAND.

[1272]—To form even a slight knowledge of Ireland requires more than a holiday visit. It is an advantage to know somewhat of its social and political history and anthropology. Very different pictures of the people are presented to the observer, according to the locality visited. The North is largely peopled with the descendants of the Scotch and English settlers that came over at the plantation of Ulster. The farmers of Down, Antrim, and Derry speak as broad Scotch, have as snug homesteads, and eat as good food as their brethren of North Britain. In the South and East there is a considerable mixture of Danish and Norman blood, particularly the latter, as is shown by the names—Fitzgerald, Fitzhenry, Fitzsimon, De Courcey, &c. With few exceptions, the farmers have comfortable homesteads, flocks of cattle, barns, and outhouses, and live on a wholesome and varied dietary. The West, including Mayo, Galway, and the Isles, is peopled by the descendants of the ancient Firbolgs or Belgæ, who are pure Celts, speak the Irish language, live in small cabins, their cattle almost invariably occupying the same apartment with themselves.

At the battle of South Moyturah, these Firbolgs were conquered by the Luatha D'Danaans, and compelled to occupy these poor and barren wastes.

They built on the Arran Isles those great Cyclopean stone cahirs or forts, which are the oldest stone monuments at present in Europe.

They are to a great extent a potato-eating people; they have preserved their language, their customs, and their dress, which does not change with the fashions, like other parts of Ireland. Tourists usually visit those places where there is fine scenery. If the West is their destination, they procure a circular ticket at Dublin and proceed direct by train to Galway. From thence by steamer to Arran, usually returning same day, as the village of Kilconan is the only place where very limited and humble accommodation can be procured. Old stagers carry their eatables and drinkables with them, and don't run the risk of having to subsist on potatoes and salt, as Mr. Williams did on the occasion of his visit. According to his own showing, and he has had experience, "It would render one unfit for any kind of vigorous mental or bodily exertion," and this would not be a desirable condition for a tourist.

Returning to Galway, the tourist goes by a two-horse public car through Connemara, or by steamer up Lough Corrib, and thence by Maam through Connemara to Westport and Ballina, finishing up at Sligo. If a longer tour is contemplated, the route by Bundoran, Ballyshannon, to Donegal is the next stage, and from thence through the Wieds, by Carrick, Glenties, and Gweedore, finishing at Letterkenny and Londonderry. Now, it so happens that the counties through which this tour lies—Galway, Mayo, and Donegal—contain the largest percentage in Ireland of poor and barren land, the largest number of small holdings, the largest percentage of people who can neither read or write, and the largest percentage of people who speak Irish. These counties supply seven-eighths of all the labourers who migrate to England to reap the harvest, which is an absolute necessity, as their holdings are too small to support their families.

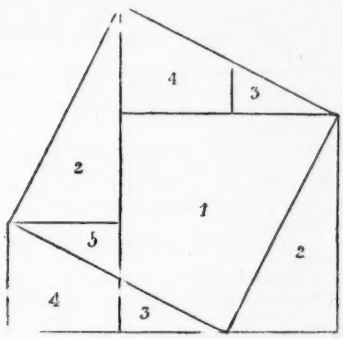
These counties include all the congested districts that have so much exercised the minds of philanthropists and of the Government. They also supply the only specimens of the wild Irish that many English people never see. These are only three counties out of thirty-two, yet, from his experience of a holiday tour in this district, Mr. Williams forms his opinion of the Irish people that they exist almost exclusively on potatoes, and in his last letter gives a most extreme example. His host on that occasion, though designated by Mr. Williams a farmer, would not be so styled in Ireland. He could not supply his guest with a cup of milk, which the humblest farm-labourer in the north could have done.

In the "Traits and Tales of the Irish Peasantry," by Carleton, are pictures from the life of the social condition of the peasantry and small farmers; and they are never represented as living exclusively on potatoes. I have travelled over all the ground I have named in Ireland, and a great deal more; have mixed with the people, and been their guest on many occasions, but I never happened so unfortunately as Mr. Williams. Should he favour us with a visit to see the north of Ireland as well as the west, we have some fine, bold scenery round the Mourne Mountains in County Down, and around the Antrim coast, by Larne, Glenarm, Cushendall, and Ballycastle, and thence to the Causeway. Should he get lost in admiration of the magnificent scenery, and get belated on the road, he is certain to procure Irish hospitality, and get something, as they say in Ireland, to kitchen his potatoes. At the village of Bushmills, where, by-the-bye, a wee drop of very good whisky is made, he can take train and go to Portrush by electricity, having a beautiful view of the headlands and the open Atlantic on the way. I am at one with Mr. Williams in his sympathy for the poor peasants in the west, and believe a brighter day is near at hand, not alone for them, but all Ireland.

SEATON F. MILLIGAN.

SUPERPOSITION.

[1273]—Your proof of 47 in KNOWLEDGE, p. 318, with a slight addition, as in the enclosed tracing, gives a good example of what



Prof. Keland called superposition. Two similar rectangles may be treated in the same way, and composed into a similar rectangle.

B. BRODIE.

DIVISION BY SEVEN.

[1274]—The following method of ascertaining the divisibility of any number by seven was brought under my notice some time ago by a friend, a pupil of Mr. Rickard, of Birmingham, who informed me that it was due to that gentleman.

Point off the given number into periods of three figures, as if for the purpose of reading it. Add together, separately, alternate periods, and find the difference of the sums thus obtained. If this difference is divisible by seven, then the original number is also divisible by seven. An example may serve to exemplify this:—Suppose it is required to know if 220,974,901 is divisible by seven. Following out the above rule, it is divisible by seven if (220 + 901) − 974 or 1121 − 974 or 147 is so divisible; but 147 is seen to be divisible by seven, hence the given number is divisible by seven.

I should much like to see the general expression for this rule, as I have not been successful in discovering it for myself.

I am led to understand that a similar method may be used for testing the divisibility of any number by 13, but have not seen it.

H. ASKEW.

FIGURE CONJURING.

[1275]—I have amused some of my friends lately with experiments on the figure conjuring according to the process given in your No. 90, vol. 4, p. 45.

In the explanation which you have appended you add "provided

always that N is not greater than 10 nor the age than 100." I submit that the proviso as to N (the month) is not necessary. The process will bring out the 11th or 12th month correctly. A proviso is necessary that if the age exceeds 99 the conjuror must be informed that it exceeds 99, and does not exceed 199, or exceeds 199 and does not exceed 299, and so on. All that he will have to do is to prefix the century to the age, found by the regular process, and deduct it from the numbers representing the month—thus:—For 25th Dec., age 110, by the regular process, the results will be 251310 (a), and he will prefix 1 to the 10, giving 110 as the age, and deduct 1 from 13, giving 12 for the 12th month. Thus:—

(a) 25.12
2
5024
5
5029
50
251450
110 age
251560
365
251195
115
25·13·10

L. W.

PERSPECTIVE OF A CUBE.

[1276]—I can hardly realise the difficulty of your correspondent signing "R. Jones," 1244, as to the perspective of a cube.

He does not give the names of the "many elementary books" which profess to show the sides to a spectator in full front; but they ought certainly to be corrected.

He, however, is in error when he asserts that the moment you see one *side* the front must be out of horizontal!

Let him only place his cube on a convenient shelf and draw on his floor a line parallel thereto.

He has answered the question as to standing exactly opposite; but, let him move a few paces *on his floor line*, either right or left, and he will immediately see one side of the cube foreshortened, whilst the front of the same remains parallel to himself, and must, therefore, be so represented.

The same will happen if *he* keeps his original position and causes *the cube* to be shifted.

In order to get the view he gives in his second diagram, either he or the cube must be twisted, *i.e.*, placed at different angles from each other. Ros. Vansittart.

Rome, May 21.

JAPANESE SUPERSTITION.

[1277]—I write to give you an instance of a superstition held by the Japanese, which you are at liberty to insert in your paper, if you think fit.

Some few days ago a friend of mine was visited by a batch of Japanese, who came to his house to ask permission to be allowed to inspect a certain large tree in his garden. My friend went out to them and asked why they wanted to see the tree. They said that a relative of theirs was very sick, and had been ailing for some time, and that they believed an enemy of theirs had driven a large nail into that sacred tree (pointing to the fine tree at the end of the garden), and until the nail was found and extracted, their relation would still remain on a sick-bed, and without hope of ever getting well.

My friend laughed, and ridiculed them, trying to persuade them out of such an absurd idea. Understanding (in fact, being a student of their language), he reasoned with the people, but to no purpose—they held firmly to their belief. My chum then waxed angry, thinking they evidently had an eye to his plate, and not the tree, tried to drive them away. But no—they would not go, and begged and implored him to allow them to examine the tree. He then gave way to the poor people, and asked them to come on a certain day, when he would be at home, and they might then search the tree as long as they liked. They then thanked him heartily, and went quietly away to their respective homes.

The day they called to inspect the tree, my friend asked me to come and take tiffin with him; just before tiffin, the Japanese marched into the garden, and made directly for the big tree, and instituted a long search. It was amusing to watch these poor heathens examining and fingering the tree, looking very anxious, and talking most seriously to one another all the time.

However, they went away at last, satisfied and quite happy at finding no nail. F. A. Vincent.

PUIR DOGGIE.

[1278]—Let "Ida" wet the doggie's feet next time, and then form the electric circuit through the *soles*. Hair is a non-conductor of the magneto-electric current. Iro.

THE CORNCRAKE.

[1279]—I and a friend have been discussing about the habits of the corncrake, or landrail; but we can come to no conclusion which will satisfy both of us. One of us supposes that the bird is a ventriloquist, and thus deceives the anxious person who wishes to find it. The other party assumes that:—1. The bird living almost wholly on the ground, must be more susceptible to vibrations caused by an approaching footstep. This susceptibility will also be heightened by the bird's quicker sense of hearing. 2. It will at once retreat under cover of the grass which, at the time of its arrival, will have begun to grow. 3. It calls to its mate from another position. If disturbed, similarly it will retreat to another position. 4. The sounds heard need not necessarily be made by one bird; there will at least be two somewhat near to each other. I am supposing that the male and female have a similar call-note. May I be allowed to suggest that the corncrake would be a good subject for an article by Mr. Grant Allen? Jno. Jos. Jagger.

WORKS ON BOTANY.

[1280]—There are many persons very fond of flowers and ferns who have not sufficient time to make botany a scientific study, but who would be glad to have a book which would be of some use to them in country rambles. Such a book I can recommend. "John's Flowers of the Field" (Society for Promoting Christian Knowledge, 4s.) gives a description of all common wild flowers, and notes most species that are rare. The introduction describes the organs of plants, and explains those terms which are necessary beyond the ordinary English words. Even should a person intend to go more deeply into botany this little book would be very useful. It contains a large number of woodcuts—most of them very good—and these are a great help to beginners.

For ferns, a very useful little book is "British Ferns and their Allies" (Routledge, 1s.), and by the time these two have been mastered the student will have learnt what books would be further useful.

Mr. Grant Allen's advice (1129) should be followed by those who intend making botany a thorough study. I would merely add that I prefer Hooker's "Flora" to Bentham's; but the illustrations to Bentham's "Flora," without the letterpress (Reeve & Co., 12s.), are exceedingly useful, and may be well used with Hooker's "Flora." G. Hann.

TRANSMISSION OF SOUND.

[1281]—The following case of transmission of sound comes to me by direct evidence on which I can entirely rely. The phenomenon has been repeatedly observed during the last two years.

The house in which it occurs is one of a row in a London suburban road, rising from south to north, and is on the eastern side. From time to time the sound is heard of the front door opened by a latch-key, and closed in the usual way. This is followed by the tread of a man's footsteps in the passage, pausing to hang up his hat, and then passing into the ground-floor front sitting-room. Everything is perfectly natural, except that no one has come into the house, and the sound is heard indifferently in all the rooms. All that is clear is that the sounds must necessarily be those of some one entering another house: the telephonic conditions are at present unknown. It is needless to add that no inquiries have been made, or any food for local gossip supplied. For this same reason I do not add my own signature.—I am, &c., Q. T. V.

COACHES.

[1282]—It is probable that some more frivolous pursuits have prevented your witnessing the recent displays of the Four-in-Hand and Coaching Clubs in Hyde-park. This is to be regretted, for you might otherwise have enlightened us as to the principle on which these stately equipages are constructed. To an ordinary

observer it would seem that the object has been to combine the minimum of comfort with the maximum of danger and expense. They are so contrived that when loaded the weight is placed as much as possible on the top, and the carriage consequently reels on the slightest provocation. The driver stands, rather than sits, on his box, with, doubtless, a good command of his horses if all goes well, but liable at any shock to be pitched on to the wheelers or the road, which has happened more than once to my knowledge. To climb to the roof is a work of danger and difficulty. It requires no little skill and practice to discover the whereabouts of the contrivances that do double duty for steps and handles; and when this preliminary knowledge is acquired, some amount of activity is requisite to make it available. But, having accomplished the feat, what is the reward? Those who are perched up in front enjoy a near view of the backs of the driver and of the happy occupant of the box-seat, whilst, for those who are relegated to the hinder part of the coach, there is the privilege of contemplating the dignified attitude and folded arms of the groom.

Now, suppose that these imitations of a byegone age were unknown. Suppose it open to competition to devise a carriage to which four horses are to be harnessed and easily driven—a carriage which is to combine the qualities of elegance, safety, convenience for passengers, a certain carrying space, and as much lightness as is compatible with strength. Is it likely that anything like the present form of "drag" would be invented and adopted? I doubt it. FREDERICK RICARDO.

COINCIDENCES.

[1283]—In the lives of two ladies, both well known, who died not many years ago, there is a curious set of coincidences, which I will illustrate as follows. Let any person be asked to answer the following question:—Who was the lady whose life history is as follows?—

Her maiden name was Marian Evans. She married a gentleman named Lewis. Soon after the death of her first husband she married a gentleman many years younger than herself. She died during the lifetime of her second husband widely known by a name which was neither her maiden-name nor the name of either of her husbands, and her death was a matter of national interest. Who was the lady?

When people are asked this question they invariably answer* [what?].—L. E. B.

LETTERS RECEIVED.

W. G. HOWARD. Thanks.—W. F. Curtis. I have no time to quibble over words. A body may (i.) be larger, (ii.) look larger, (iii.) or seem to look larger,—the first by real change of size, the second by approach or by magnification through a lens or the like; the third by illusion. The sun and moon only seem to look larger when near the horizon; they subtend no larger an angle. It is an optical illusion. The atmosphere has no magnifying power such as you imagine.—THOS. HOWELL. Have nothing to do with advertisements. Please apply to the publishers.—E. A. TINDALL. Thanks. It is rather the geometrical position of the planets than their position in the heavens which is in question. Doubtless Whitaker's Almanac shows well enough where each planet is on the sky. But many are interested to know where each planet lies in space. The trouble about such problems is that about a hundred solutions are sent in, and each solver expects his to be not only mentioned, but examined. For this neither our time nor space suffices. Mr. Prince has published, but we believe for private circulation only, much of the work of Hevelius.—A. R. DAMES. Not at all improper; but we are not able to give time to such matters.—A. E. BEAN. The constant of aberration represents the angle whose sine is the distance traversed by the earth in a second, while the radius is the distance traversed by light in a second. Hence its determination gives the velocity of light; and knowing the velocity of light we can tell how far away the sun must be for elipses of Jupiter's satellites to seem hastened or delayed so much as they are observed to be, according as the earth is on the side of her orbit towards or away from Jupiter. We could not well give the solution of the problem in detail.—A. J. HARVEY, F. J. DOWNEY. Quite impossible. After about two hours' talk with you I might form an idea what might perhaps suit you as a course of universal history. And very likely what I might suggest would not suit you.—RICHARD E. Have not been in town long enough to see that picture. Thanks.—W. CLARK. Am away from my books; but think Scoresby found in the Atlantic no wave higher than 40 ft. from trough to crest.—ROS. VANSITTART, HESPERUS. It is impossible to decide so suddenly whether a reflector or a refractor is the better sort of telescope, or what book of astronomy a beginner should start with.—J. H. E. H. Elliptical orbits is too precise an expression; up and down does better; it does not mean in straight lines.—M. T. (i.) It was a vain fancy; an empty notion; not based on science, and *one* which theologians should have scouted. *What* an interpretation! The account says they saw his star, and some would vainly suggest that they saw three planets too near together to be separately discerned. (ii.) The south magnetic pole has never been reached. It is not opposite the north magnetic pole: no doubt like that pole it changes in position. —A FACTORY HAND. My dear sir, I don't care a brass farthing to convince you or any others among the "intelegient" artisan class that the earth is not flat. I doubt whether a man exists, artisan or otherwise, of decent "intelegientz" (how's that, umpire?) who really imagines the earth is flat. Parallax knows better, a thousand times. I have done enough in bringing out the facts that (i.) every pretended proof of earth flatness is a falsehood, and (ii.) that the pretended system of science called the Zetetic has been advanced for no other purpose on the face of the earth (round flat or polyhedral), but to help sell quack medicines. Do you suppose I am likely to care to convince folk who are (on the face of things) either utter rogues or utter fools? One set *won't*, the other can't see. I can neither make one see nor help the others. And I do not want to. KNOWLEDGE is for folks having an average brain power above the Earlswood matriculation standard.—JOHN HAMPDEN. The same to you.—SAM RIDEAL. Thanks: but no space for the earthquake essay. I wonder if the "seismic energy" really has frightened folk in England. For my own part my idea of my countrymen in this matter is that

Si fractus illabatur orbis
Impavidum ferient ruinæ,

which being freely translated means that if St. Paul's and the Monument were falling about their heads they would placidly order dinner among the ruins.—A. N. SOMERSCALES. Stay awhile, and I will form an opinion about the resistance to bicycles.—MOLECULE. Dear Brother Molecule, wait till your dream (which gave me as cold a shiver as you could have wished) has been fulfilled. (The moan was probably a misinterpreted furniture-squeak.) At present my only idea is to ask, What had you taken for supper? I am, in any case, not a Daniel, to interpret the dreams of others.—DIOGENES. Really we cannot give the treatment of such problems; we are not private tutor to each of our multitudinous readers. If we were we should get a tidy income at average rates for such work.—H. J. MADGE. I fancy the history of ninety-nine out of a hundred collisions is scarcely consistent with the views you express. —J. BELL. I should like to have the details of your wonderful (window)-paneful experience more precisely. You say the panes flew out; but how? Did they fly out and fall in pieces on the road? or fly out and stop out, in the air? or how? The coincidence is of a kind which would be full of interest if confirmed by names, dates, confirmatory statements as to notes made at the time and so forth.—F. DOUGLAS. Ah! my dear young friend—to adopt your own kind manner—for I presume you are young, nay that you are very young,—and a trifle foolish (but that is a detail), oh! consider your ways in time. Ah! remember that time is a blessing, and reason is a God-given quality, not to be frivolously wasted in idle dreams. Oh! remember that you have time for work and for good work; if you are only willing. Ah! consider that if you waste time now you are young, the end of your life may come and find very little done of the good you might have done. And oh! remember that every man may find enough in his own field of work, and mayhap too much, and that looking over a neighbour's hedge to inquire too curiously what work he may be doing, is but an idle way of passing the time. Oh! my dear young friend reflect; and ah! my poor foolish friend remember; and oh! would you but mind fervently your own business, ah! how very much better might it be for you, yea, and for me, and mayhap for many more. Wherewith I bid you fervently farewell, and pass on my way rejoicing.—B.M., F.R.C.S., thanks for interesting letter, which shall appear soon.—A. F. RAVERNSBEAR. Your thoughtful letter shall appear; albeit, I doubt if the murderously minded are so numerous or so clever that we need consider *them* so much as you suggest.

* They generally answer in one way. Our correspondent gives what is in reality the truer answer: but we leave the question for a fortnight to see what the answer is likely to be.—R. P.

*** Owing to an unusual pressure of letters and questions we must leave many correspondents unanswered this week. We have not even been able to initial all the letters received,—not a very useful work in any case. But all correspondents may rest assured that due notice has been or will be taken of their communications.

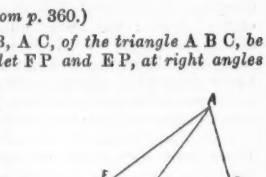
Our Mathematical Column.

NOTES ON EUCLID'S FIRST BOOK.

By Richard A. Proctor.

(*Continued from p.* 360.)

Prop. XXVI.—*Let the sides,* A B, A C, *of the triangle* A B C, *be bisected in the points* F *and* E, *and let* F P *and* E P, *at right angles to* A B, A C, *meet in* P: *then the line drawn from* P *at right angles to* B C *shall bisect* B C *in* D; *and the line drawn from* P *to bisect* B C *is at right angles to* B C.

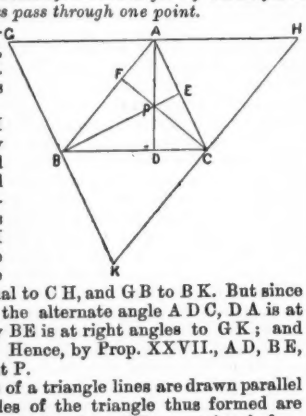


For, because A F is equal to F B, and F P is common to the two triangles A F P, B F P and at right angles to A B, these triangles are equal in all respects. Therefore B P is equal to A P. In like manner A P is equal to P C. Therefore B P is equal to P C. Hence, in the isosceles triangle B P C, P D at right angles to B C, bisects B C in D, and *vice versâ*.

Prop. XXVII.—*The three lines bisecting the sides of a triangle at right angles pass through one point.*

If F P, E P two of these bisectors (same fig.) meet in P, the third bisector, through D shall pass through P. For if it has any other position as D Q, the angle B D Q is a right angle. But, by Prop. XXVI., P D is at right angles to B C. Therefore the angle P D B is equal to the angle Q D B, which is absurd. Therefore the perpendicular from D passes through the point P.

Prop. XXVIII.—*The lines drawn from the angles of a triangle at right angles to the opposite sides pass through one point.*



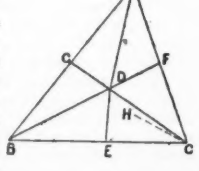
Let A D, B E, C F, be perpendiculars on B C, C A, A B, the sides of the triangle A B C. Then shall A D, B E, C F pass through one point.

Through A draw G H parallel to B C, through B draw G B K parallel to A C, and through C draw K C H parallel to A B. Then G C is a parallelogram, and therefore G A is equal to B C. Similarly A H is equal to B C. Therefore G A is equal to A H. In like manner K C is shown to be equal to C H, and G B to B K. But since the angle G A D is equal to the alternate angle A D C, D A is at right angles to G H; similarly B E is at right angles to G K; and C F is at right angles to K H. Hence, by Prop. XXVII., A D, B E, and C F pass through one point P.

Cor.—If through the angles of a triangle lines are drawn parallel to the opposite sides, the sides of the triangle thus formed are bisected at the angles of the first triangle, and form a triangle four times as great as the first triangle (Prop. XX).

On account of the importance of Proposition XXVIII. we shall give other proofs of it presently.

Prop. XXIX.—*In the triangle* A B C *let the lines* A D, B D, *bisect the angles* B A C, A B C *respectively; then shall* C D *bisect the angle* A C B.

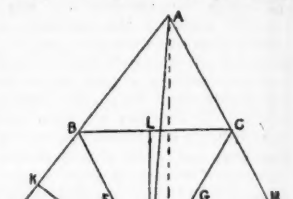


Draw D E, D F, and D G perpendicular to B C, C A, and A B respectively. Then the triangles A G D, D E F are equal in all respects (Euc. I., 28); therefore D G is equal to D F. Similarly D E is equal to D G. Hence D E is equal to D F: and in the triangles D C E, D C F, D E is equal to D F; the angles D E C, D F C, opposite to the common side, D C, are equal (being right angles); and the angles D C E, D C F, opposite to the equal sides D E and D F are both acute (Euc. I., 17), since the angles at F and E are right angles. Hence the triangles D C E, D C F are equal in all respects; therefore the angle D C B is equal to the angle D C A.

Prop. XXX.—*The three lines bisecting the three angles of a triangle pass through one point.*

If A D, B D, two of the bisectors, meet in D, the third must pass through D; for if it had any other position, as C H, then the angle E C H would be equal to half the angle B C A. But, by the preceding proposition, D C E is equal to half the angle B C A. Therefore the angle D C E is equal to the angle H C E, which is absurd. Therefore the three bisectors all pass through one point.

Prop. XXXI.—*If two sides* A B, A C *of the triangle* A B C *be produced to* D *and* E, *and the angles* D B C, E C B *be bisected by the lines* B F, C G, *these bisectors will meet, and the line joining the point in which they meet with* A *will bisect the angle* B A C.



For the angle D B C is less than two right angles, and therefore the angle F B C is less than one right angle. Similarly the angle G C B is less than a right angle. Therefore the two angles F B C, G C B are together less than two right angles, and B F, C G will meet if produced far enough. Let them meet in H, and draw H K, H L, H M perpendiculars on A D, B C, and A E. Then, the triangles H B K, H B L, are equal in all respects (Euc. I., 4); therefore H K is equal to H L. Similarly it may be shown that H M is equal to H L. Hence H K is equal to H M. Therefore in the triangles H K A, H M A, K H is equal to H M, the angles A K H, A M H opposite to the common side H A are equal (being right angles) and the angles K A H, M A H, opposite the equal sides K H, M H, are both acute—Euc. I., 17 (since the angles at K and M are right angles); hence the triangles K A H, M A H are equal in all respects; and therefore the angle K A H is equal to the angle M A H.

Cor.—If two exterior angles of a triangle are bisected the intersection of the bisecting lines is equidistant from the three sides of the triangle.

Prop. XXXII.—*If two sides of the triangle* A B C (*same figure*) *be produced to* D *and* E, *the lines bisecting the three angles* D B C, B A C, *and* E C B, *will all pass through one point.*

Let the bisectors of the angles D B C and B C E meet in H; then the bisector of the angle B A C must pass through H. For if it had any other position as A N, the angle N A M would be equal to half the angle B A C. But, by the preceding proposition, the angle H A M is equal to half the angle B A C. Hence the angle H A M is equal to the angle N A M, which is absurd.

Cor.—The bisectors of the angles B A C, B C E intersect, and the line joining their intersection with B bisects the angle D B C.

(*To be continued.*)

EASY RIDERS ON EUCLID'S FIRST BOOK,

With Suggestions.

Prop. 30.

88. The parallel lines A B, C D, and E F are intersected by the line B D F G; show that the bisectors of the angles A B G, C D G, and E F G are parallel to each other.

89. With the same construction as in Ex. 81 show that the lines bisecting the angles A, C, and A E C, are parallel to each other.

Prop. 31.

90. From a given point without a given line draw a line which shall make a given angle with the given line.

91. Draw a line D E parallel to the base B C of the triangle A B C, so that D E shall be equal to B D.

92. A B C is an isosceles triangle. Determine points D, E in A B, A C respectively (these being the equal sides of the triangle) such that the lines B D, D E, and E C may be equal to each other.

93. Draw a line D E parallel to the base B C of a triangle A B C, so that D E may exceed C E by a given length.

94. A B C is an isosceles triangle. Determine points D and E in A B and A C produced, so that D B, B C, and C E may be equal to each other.

B E *must be the bisector of the angle* D E A *and therefore must be parallel to the bisector of the angle* A C B.

95. Draw a line D E parallel to the base B C of the triangle A B C, so that B D and C E together shall be equal to the line D E.

Suppose the line drawn, and take a point P *in it such that* D P *is equal to* B D, *and therefore* E P *to* C E. *Notice that the triangles* B D P *and* C E P *are isosceles, &c.*

96. Draw a line D E parallel to the base B C of the triangle A B C, so that D E shall be equal to the difference of B D and C E.

Suppose D E *drawn as required, and produce* D E *to* P *making* D P *equal to* D P (*supposed greater than* C E.) *Then* E P *is equal to* E C, *and the triangles* B D P *and* C E P *are isosceles, &c.*

PROP. 32.

97. If one angle of a triangle is equal to the sum of the other two the triangle is right angled.

98. If one angle of a triangle be greater than the sum of the other two the triangle is obtuse angled.

99. In an acute-angled triangle the sum of any two angles is greater than the third angle.

100. If the base of an isosceles triangle be produced, the exterior angle exceeds a right angle by half the vertical angle.

101. If the base of a triangle be produced either way, the sum of the two exterior angles thus formed exceeds two right angles by the vertical angle of the triangle.

102. If the three sides of a triangle be produced either way, as in the preceding example, the sum of the six exterior angles thus formed is equal to eight right angles.

103. If F G be joined in the figure to Euc. I., 6, B C and F G are parallel.

104. In the figure to Euc. I., 8, the difference between the angles D and G is equal to the difference between the angles D E G and D F G.

105. In the figure to Euc. I., 21, the angle B D C exceeds the angle B A C by the sum of the angles A B D and A C D.

106. In the triangle A B C, B D and C D are drawn bisecting the angles A B C, A C B. Show that the angles B A C, D B C, and D C B, are together equal to the angle B D C.

107. With the same construction show that the angle B D C exceeds a right angle by half the angle B A C.

108. Determine the magnitude of the angles of a regular pentagon.

(To be continued.)

Our Whist Column.

WHIST-TORTURE.*

THE absence of intelligence we cannot help. Inattention is unpardonable when another's welfare is at stake. If we could establish a Whist Bee, we doubt (if the players were examined without notice) whether in the middle of a hand one-half of the players could tell the trump card. We saw a player lose a rubber a short time ago. He had a Heart (all the trumps were out), and his partner had all the rest of the Hearts palpably in his hand. His partner said, "We had every trick. You knew I had all the Hearts, and yet you would not lead one." This is scarcely a fair way of putting it. We often hear men say, "You knew I had so and so," but the fact is (as in this case) the player knew nothing about it. He had no more notion of the position of the Hearts than of any other card. He has not the faculty to infer. A player may reason incorrectly, but some do not reason at all. Thus *A* leads Ace in a plain suit, and follows with another round. Second hand wins with the King, and returns the suit. The now second player (*A*'s partner) has none of the suit, and with a strong trump hand he puts on the trump 2. With a strong hand he trumps a doubtful card, doubtful we mean from his point of view. He did not stop to realise what *A* had led from. He does not attempt to place himself in his partner's position. He might have reflected and said, "What does the lead of Ace and another mean?" My partner is of one school or the other. He may have led Ace and another, desiring to trump. Bad play, we think; but there are players who thus play, and we must take men as we find them. If he be of the ruffing school, surely it would be good policy to let him trump instead of my so doing, and in the meantime by my discard I can tell him my suit. But he may further reason, "An Ace and another originally led should mean my partner has five of the suit. If so, there is no reason why he should not have the Queen; why, therefore, with my strong hand, should I trump a doubtful card?" Some such reasoning as this should pass through his mind. It is but the work of a second, and the result either way should be to induce the player to avoid doing what he did do, viz., trump and get overtrumped. The first Whist lesson, we have said, should be to keep your eye on the table, not to let the attention be drawn to other parts of the room, and not to let the eye rest on your own cards. The last defect is the reason for many of the stupid things we see committed at Whist by men of intelligence. The second lesson is to attempt to reason. A bad reason is better than none at all; with practice, the reasoning faculty should become sharpened, and that which is at first an effort will become mechanical. Let us not be misunderstood. The reasoning process must take place in the player's mind. It must not break out into fervid declamation or testy argument; and the third lesson to be drawn from the above example is the value of a discard.

The best players have not yet fully realised this most difficult subject. The number of games won and lost by a discard is incalculable. In the case before us we have the discard in its most simple form, it at once directs *A*'s attention to *B*'s suit, and the knowledge of that suit governs the play during the remainder of the hand. When a player once realises the value to him of a discard, he may be induced to think of the value of a discard to an opponent; thus, when a player passes a winning card he knows we suppose that he is giving away a trick, but does he reflect that he may be doing much more than that? The discard that the third player may make will tell his partner what to do, and in like manner again direct the remainder of the game. The players who are so stingy that they will not sacrifice one of their trumps on a winning card seldom become good Whist players. It is much better to play a small trump with the certainty that it will be overtrumped, than to let the trick go. The same stinginess often loses a game when the second player will not cover the second best of a suit because he knows the third player will trump. The third player does not trump, partly because he suspects the second player is holding up, or because he thinks his partner desires to clear the suit, or lastly, because the player can get a good discard. The odd thing about this is that the stingy player, who will not sacrifice one of his trumps or good cards, is the player of all others that does not hesitate to sacrifice his partner's cards. He who is a screw with his own is the most venturesome with his partner's. This style of player, with weakness in trumps, is sure to lead trumps. Will they never realize that the cards of their partner are for the purpose of the game, their own cards; that they play with 26 cards on their side, and not 13 only. There is a little point in play that weak players do not seem to understand. A player leads originally for a ruff, and he finds (happy man) his partner with the command of the suit, and the leader gets two discards. The case we saw was this:—*A* led a single Spade, his partner had Ace, King, Queen, and *A* got rid of the ten and nine of diamonds. By the fall of the cards the last player cannot have another spade, so that *B* knew that if his partner trumped he would be over-trumped. To continue the spade was bad play, *B* had the Diamond Ace, and he could have led that and followed with another; when *A* would have had a better chance for the ruff; or he could have led the plain suit which is presumedly his partner's; or he could have led trumps, seeing that *A* could only have two suits and one Diamond, Queen or Knave, or two Diamonds, Queen Knave or King Knave. It would seem improbable that a player would lead a singleton with a suit of King, Knave, ten, nine, or Queen, Knave, ten, nine, and of course in such matters we must be guided to some extent by our knowledge of the players; because there are old-fashioned and new-fashioned players. The one would lead the singleton to make a trump, and the other would only venture on a singleton when he has great strength in trumps; but neither school ever lead the singleton with such a four suit as King, Knave, ten, nine, or Queen, Knave, ten, nine. We should therefore expect to find that *A*'s original hand consisted of single Spade, three Diamonds to the Knave, four trumps all small, and five of the other suit, so small that the player calculated that by no possibility could he establish the suit. Then having got three tricks and Ace of Diamonds for the fourth, we should have been inclined to go for the fifth on the Diamonds. Our partner has asked to be forced, and we can force him with greater advantage in Diamonds than we can in Spades. We do not say this is good play, but by analogy we are justified in the force, and the force in the one suit is clearly better than in the other.

It is useless to tell any player that, except in critical positions, it is seldom any use to pass a King in a plain suit having the Ace. If men will not learn this by pocket experience, they will not learn it from our preaching or from reason. It seems equally useless to protest against one partner taking another's trick without weighty reason, and without an accurate knowledge of the position of the cards. As to forcing without justifiable strength, this is too sore a point to be touched upon. The player of six years old should occasionally look to the score, but we are satisfied that players of sixty years and upwards often fail to do so, and as to clearing the partner's suit, and getting out of his way, one would fancy the players had been brought up on the top of a 'bus, where the chief business and pleasure in life seems to consist in blocking the way.

If we add that those players who pretend to understand the value of the discard generally reverse their theory in practice; they are afraid to lead a winning card, because some one will get a discard; we think we have suggested and recalled as many subjects of torture as were ever invented in the Middle Ages.

* The above capital paper we extract from "Jottings," by Mr. Mossop, editor of the *Westminster Papers*.

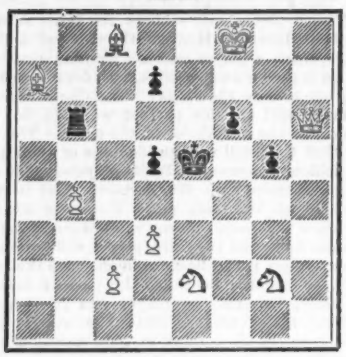
Our Chess Column.

By Mephisto.

PROBLEM No. 119.

By H. W. Sherrard

Black.

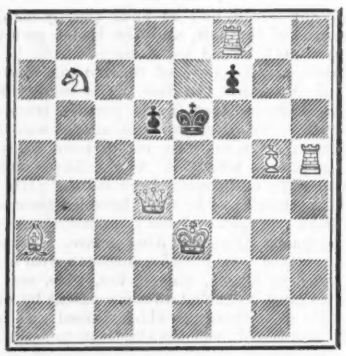


White.

SELECTED PROBLEM.

By S. Lloyd.

Black.



White.

White to play and mate in two moves.

One of twelve blindfold games played simultaneously by Dr. Zukertort on the 25th ultimo.

EVANS' GAMBIT.

White. Dr. Zukertort.	Black. Mr. O. M. Tennison	White. Dr. Zukertort.	Black. Mr. O. M. Tennison.
1. P to K4	P to K4	10. Kt takes P	Kt to Q sq (*a*)
2. KKt to B3	QKt to B3	11. B to R3	P to QB3
3. B to B4	B to B4	12. QR to Q sq (*b*)	P to QKt4
4. P to QKt4	B takes KtP	13. B to Q3	Q to K3
5. P to B3	B to R4	14. Kt to K4	B to QB2 ? (*c*)
6. P to Q4	P takes P	15. Q to B2	P to KR3
7. Castles	P takes P	16. KR to K sq (*d*)	Kt to QKt2
8. Q to Kt3	Q to B3	17. Kt to Q6 (ch)	K to Q sq
9. P to K5	Q to Kt3	18. B to KB5 ! (*e*)	

And Black resigns.

NOTES.

(*a*) Very inferior, and leading at once to inextricable difficulties. 10. * * KKt to K2 is proper.

(*b*) Clearly enough foreseeing that Black's plans will only result in playing his adversary's game.

(*c*) This only makes matters worse. 14. * * Q takes Q might have somewhat delayed the attack, but even then Black remains with an execrable, if not a losing, position.

(*d*) Played with wonderful accuracy, considering that Dr. Zukertort was simultaneously carrying the complication of eleven other games in his head.

(*e*) Applying the *misericordia*.

Played April 30, 1884, at New Orleans.

TWO KNIGHTS DEFENCE.

White. Mr. Jas. M'Connell.	Black. Dr. Zukertort.	White. Mr. Jas. M'Connell.	Black. Dr. Zukertort.
1. P to K4	P to K4	15. P takes Kt	Q to Kt3 (ch)
2. Kt to KB3	Kt to QB3	16. K to R sq	Q to R4
3. B to B4	Kt to B3	17. R to K3	K to Kt sq
4. Kt to B3 (*a*)	B to Kt5 (*b*)*	18. R to KKt sq	B to R6 (*f*)
5. P to QR3	B takes Kt	19. Q to Q4	Q to B2
6. QP takes B	Kt takes P (*c*)	20. B to R6 !	P to KKt3
7. B takes P(ch)	K takes B	21. Q to R4 ! (*g*)	B to K3
8. Q to Q5 (ch)	K to K sq	22. B takes R	R takes B
9. Q takes KKt	P to Q4	23. R from Kt sq to K sq	R to K sq
10. Q to QR4	Q to Q3	24. K to Kt sq !	B to Q2 (*h*)
11. Castles	R to B sq	25. R takes R(ch)	B takes R
12. R to Ksq (*d*)	K to B2	26. R to K7	
13. Kt takes P(ch)	Kt takes Kt		
14. B to B4 (*e*)	Kt to B6 (ch)		

And Black resigns.

NOTES.

(*a*) This resolves the opening into a variation of the Giuoco Piano. 4. Kt to Kt5 was best.

(*b*) The ordinary continuation here would be: 4. * * B to B4; 5. P to Q3, P to Q3; 6. Kt to K2, or 6. Castles, with an even game.

(*c*) Taking greater risks, we are inclined to believe, than the benefits derived warrant.

(*d*) Mr. McConnell considers this the key move to White's successful conduct of the game from this point.

(*e*) 14. Q to KB4 (ch) is apparently better, *e.g.*: 14. Q to KB4 (ch), K to K3 (if K to Kt, 15. Q takes Kt, remaining with a rather better game, and a Pawn ahead); 15. Q to KKt4 (ch) when if Black play R to B4; 16. P to KB4, &c.

(*f*) Evidently with an eye to QR to K, but there is no time under White's vigorous attack.

(*g*) All of this is very well managed.

(*h*) Overlooking the annihilating resource at his antagonist's command.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Correct solution received of Selected Problem from Stettin, George Gouge, Caissa, E. Ridgway, A. W. Overton.

Inquirer.—The King is in check.

Clement Fawcett.—If Q takes Kt, then B takes B, and there is no mate.

S. Balliozian (Smyrna).—Problem 118. If R to K8 (ch), K to Q6, B to R6 (ch), the R interposes. No. 117 has two solutions. See p. 361.

Clement Fawcett *v.* F. Watson.

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The following arrangements are complete: the numbers in brackets referring to above list.

RICHMOND (Star and Garter), June 5, 6 (1, 2).

NOTTINGHAM, June 11, 12, 18, 19 (1, 2, 3, 4).

NOTE.—*All communications respecting Lectures should be addressed to Mr. John Stuart, Royal Concert Hall, St. Leonards.*

* We prefer Kt takes P.